ELECTRICAL REVIEW

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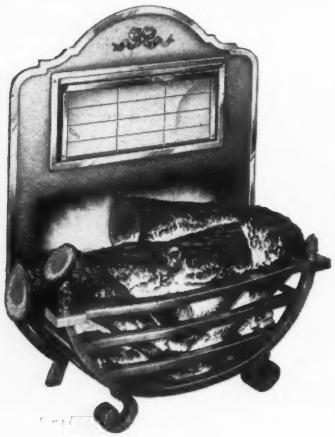

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ELECTRICAL REVIEW

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Next Week's Convention

WHEN the long series of annual conventions organized by the Incorporated Municipal Electrical Association came to an end with the disappearance of its sponsors under nationalization it was felt that a gap had to be filled. Largely through Lord Citrine's influence it was decided to hold in 1949 a convention embracing all sections of the electrical industry. This was widely regarded as an experiment, for the results of a previous National Electrical Convention (1935) had not been too encouraging. Anyhow the Convention duly took place and in spite of forebodings was very successful, although not all sections of the industry were equally enthusiastic about it.

Once again the principal credit for this goes to Lord Citrine who served as president and we may say that the continuation of the Convention's success has been due to the men who in turn succeeded Lord Citrine—Sir Vincent de Ferranti, Sir Henry Self, Mr. P. V. Hunter and Sir John Hacking. It is evident, then, that one important requirement is a good president, acceptable to all sections, a requirement which is again fulfilled this year in Mr. J. R. Beard.

It has to be said again that the Convention (in spite of the implication of its title) is not an electricity supply conference. All branches of the industry and profession are equally responsible for it and participate as equal partners. The catholic nature of the Convention is evident in the papers which are read and discussed. Including those who are presenting papers at next week's Convention (the sixth), the authors' affiliations are as follows:—B.E.A. and Electricity Boards (including research) 14; manufacturing (covering a number of branches and research) 23; contracting 2; consulting 2; and E.A.W. 1.

The papers range over a wide variety of subjects and are valuable in keeping members of the various sections in touch with what is going on outside their immediate fields, a kind of integration which is badly needed in this age of specialization. They are generally written in an easily-digested way so that if the public Press desires it can present some interesting and useful information to its readers. Unfortunately the opportunity is not fully taken but the Convention does gain some publicity for the industry and is thus of a " developmental " character.

Next week's papers again display variety and comprehensiveness the subjects being the interdependence of home and export electrical trade; modern industrial, commercial and domestic lighting; electricity in the modern home; domestic load development (home and overseas); and British and overseas installation practice. Although this indicates a busy time there will be ample opportunities for social contact which is the most important side of the Convention, for it is an excellent means of binding together the many industries within the complex electrical industry.

MORE FOR THE B.E.A.

It is indicative of the rapid expansion of the electricity supply industry in the last few years and of the tremendous programme on which the industry has embarked that it has become necessary to double the British Electricity Authority's borrowing powers. These were fixed at £700 million in the 1947 Electricity Act; the Bill introduced last week raises the limit to £1,400 million, which is the estimated requirement up to 1960. The Minister of Fuel and Power has stated that the present borrowing powers are likely to be exhausted by the end of this year; the amount which will actually have been sanctioned by 30th June is £635 million. Details of the Authority's expenditure up to 1960 are given elsewhere in this issue. The total is put at £2,121 million, of which about a third will be financed from internal sources. It is noteworthy that in contrast the cost of the gas industry's programme up to 1960 is £579 million. To explain and justify this great increase in its borrowing powers the B.E.A. has produced a handsome illustrated brochure, "Power and Prosperity," in which it shows this country's need for more and more electricity to increase industrial production and raise the standard of living. In outlining future developments it makes special mention of its plans to install 200 MW sets and to go ahead as rapidly as possible with the generation of electricity from nuclear energy.

ALUMINIUM-SHEATHED CABLES

A significant advance in the technique of cable manufacture has recently been made at the Prescot works of British Insulated Callender's Cables, Ltd. The installation of a unique press now makes possible the continuous extrusion of aluminium for power cable sheathing to any desired length. Satisfactory welds between billets and the elimination of weakness at "stop marks" mean that commercial grades of aluminium can now be used to provide sheathing to fulfil all required conditions. However, much remains to be done in equipping the press with the tools required for a comprehensive range of cable sizes and improving its performance over that range. In spite of this, enough has been done to indicate that a thoroughly practical solution has been found to a problem which has engaged the attention of cable makers and press designers for many years. It is gratifying to know that British technique and workmanship have been responsible for this achievement.

"DIFFERENTIALS"

It is complained in the May issue of the *Electrical Supervisor* that the difference between the salaries of supervising electrical engineers and the wages of those they supervise is becoming less and less. A similar grievance is nursed by the Electrical Power Engineers' Association. Two reasons for this position may be mentioned. First, people in the higher ranks of industry have a sense of responsibility and restraint; they realize that increases in pay generally result in higher prices, by which they are negatived. Secondly, if they are ultimately forced to claim higher salaries they are so much a part of management that they feel unable, through their associations, to take the action which is open to the ordinary trade union. Yet such people are so valuable a section of industry that they should not be allowed to harbour feelings of dissatisfaction. It is not just that they should see their conditions worsening, and the effect on recruitment is serious. Men are unwilling to take on responsibility if they can be as well off in less-worrying jobs. To grant them increases adds to costs of production, but is the addition of great significance when compared with what has already been conceded to those in the lower ranks?

ACCIDENTS IN THE MINES

During discussions on the annual report of H.M. Principal Electrical Inspector of Mines at meetings of the Association of Mining Electrical and Mechanical Engineers it has been made apparent that the large number of electricians involved in accidents is causing grave concern. The increase in the number of electrically driven machines, resulting in a greater potential risk of shock, has been suggested as a possible reason for this. However, tables are reproduced in the recently published report of the Principal Electrical Inspector for the year 1951, to show places where the accidents occurred during the ten years 1940-49 inclusive, and this indicates that the electrical apparatus is not responsible for the majority of such accidents. Of the 137 accidents underground and 100 on the surface during the ten-year period it is disturbing to learn that 77 and 59 respectively were the result of negligence. It is a pity that publication of the report should have been so long delayed.

Mr. J. R. Beard

THIS year's President of the British Electrical Power Convention is a leading British consultant, Mr. James Robert Beard, C.B.E., M.Sc., M.I.C.E., M.I.E.E., senior partner of Messrs. Merz & McLellan. Mr. Beard was born in 1885 and after attending the Manchester Grammar School he studied engineering at the Victoria University of Manchester. He then joined the Newcastle-on-Tyne Electric Supply Co., later going to the Cleveland & Durham Electric Power Co.; both companies were subsequently merged in the North Eastern Electric Supply Co. After a time he joined Messrs. Merz & McLellan and became a partner in 1930.

Mr. Beard was elected an associate member of the Institution of Electrical Engineers in 1912, becoming a member six years later. He was chairman of the North Eastern Centre in 1920 and served for two periods on the I.E.E. Council. He was elected vice-president in 1937 and became president in 1940-41. Among his many other activities, Mr. Beard has served on B.S.I. and E.R.A. committees; he was president of the Association of Supervising Electrical Engineers from 1937 to 1939; a member of the panel of technical advisers which assisted the North of Scotland Hydro-Electric Board in drawing up its original development schemes; and chairman of the Association of Consulting Engineers in 1945-46. He was made a C.B.E. in the 1950 New Year Honours

James R Beard

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East Sussex and South West Kent Sub-Area

Background to the 1954 Convention

By N. BOYDELL, M.I.E.E., A.M.I.Mech.E.*

EASTBOURNE, where the 1954 British Electrical Power Convention is being held, is referred to in the holiday guide books as the "Suntrap of the South" because, we are told, it has so often figured amongst the top of the sunshine records of British resorts. Thousands of people come here every year to enjoy the sunshine and the many and divergent attractions. Eastbourne appeals to almost all types of holiday makers but there is nothing garish about it, and its popularity springs mainly from the enjoyment naturally derived from being in a fashionable resort endowed with a splendid seafront, first class hotels, and a wide variety of entertainment and which is a convenient centre from which to explore the delightful countryside and the many places of historical interest round about.

So far as the distribution of electricity is concerned, however, Eastbourne is within the East Sussex and South West Kent Sub-Area of the South Eastern Electricity Board and it is on the outskirts of the town, on the main Eastbourne–London road (A.22), that "Westlords," the Sub-Area headquarters, is situated. The Sub-Area covers approximately 800 square miles and includes Eastbourne, Pevensey, Bexhill, Hastings, Winchelsea and Rye on the southern coastline, East Grinstead, Tunbridge Wells and Tonbridge to the north west and a large part of the Sussex and Kent Weald in between and to the north east. It is an area rich in history and one only has to mention 1066 to conjure up vivid pictures of Duke William of Normandy landing with his invading army on Pevensey marshes and later doing battle with King Harold and his Saxon warriors already tired from their victory over the invading Norsemen.

There are many castles in the area—some in ruins and others in an excellent state of preservation. The Anderida Castle at Pevensey, which is now merely a shell, was built

*Manager, East Sussex and South West Kent Sub-Area, South Eastern Electricity Board.

originally as a Roman fort in the latter part of the third century. After the Conquest, a Norman Castle was built in the south east corner of the Roman fort and the fort itself, after lying derelict for about six centuries, was made to serve as the outer bailey. In 1940, with the threat of German invasion the castle was once more prepared for defence and " pill boxes " were constructed, some on the bastions of the Roman wall, and disguised to look like ancient masonry. Fortunately, they were never put to the test.

At Hastings too there are the ruins of a Roman Castle on West Hill. There is a fine 14th century moated castle at Bodiam which is open for inspection and, of course, the beautiful 15th century castle (restored in recent years) at Herstmonceux which is now the home of the Royal Observatory from Greenwich. Another castle, a 16th century one, is at Camber between Winchelsea and Rye, former Cinque Ports from which the sea receded long ago. There are the picturesque ruins of Scotney Castle on an island in a lake near Lamberhurst and Sissinghurst Castle, north east of Cranbrook, where a fine Tudor tower is preserved. There are also the remains of a Norman castle at Tonbridge where the well known public school was founded in 1553.

It is not possible to mention in an article of this kind all the places which are interesting either for their historical background or their natural beauty, but it would no be right to leave out famous Beachy Head, that great chalk liff west of Eastbourne which rises to a height of over 5 oft sheer from the sea. After looking over its edge at v hat appears to be a very diminutive lighthouse (actu lly 142ft high) set in the rocks and water beneath, an exam na-tion of the coastline eastwards will reveal several Mart llo Towers, those circular forts built at the time of the inva ion scares of the Napoleonic wars.

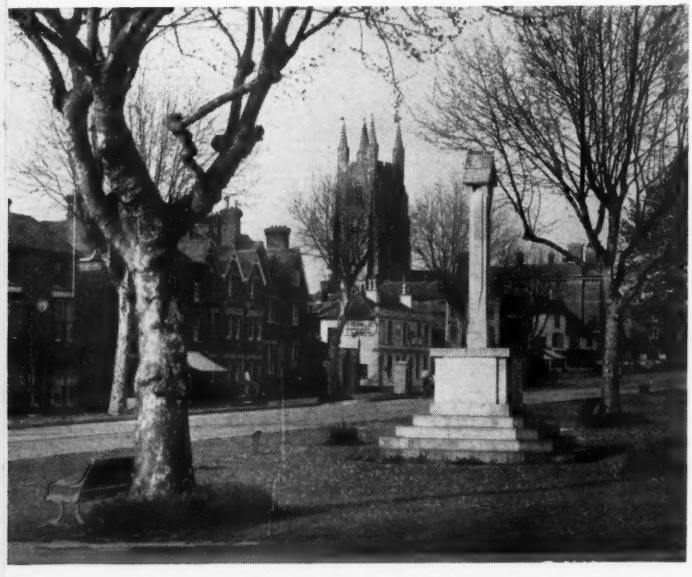
To the north and west roll the South Downs and six miles away lies Wilmington with its ruined Benedic ne Priory and its famous " Long Man." This " L ng Man " or " Wilmington Giant " is considered to be on of the great prehistoric monuments of England and is he outline figure of a man, approximately 230ft high, carry ng a long staff or spear in each hand, the figure being cut in he turf on the steep north face of the hill.

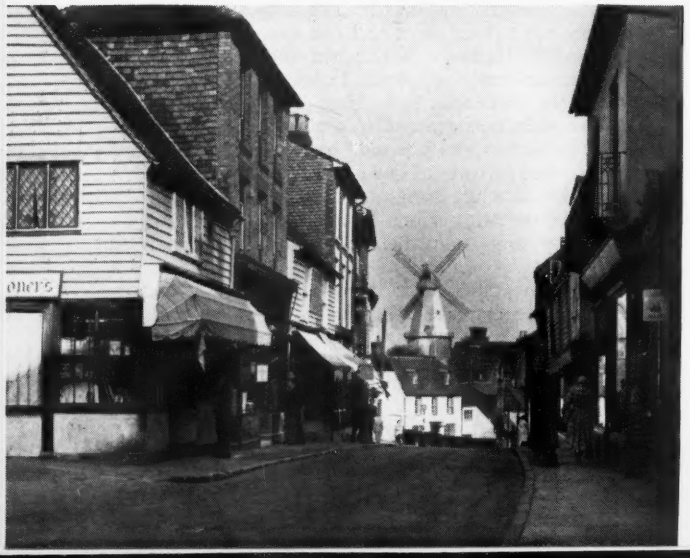
To the north and east stretch the wealds of Sussex nd Kent with their farms and orchards and hopfields. Here is unspoilt countryside with its busy agricultural com-munities, picturesque farm and oast houses, delightful villages with their ancient churches, inns and village greens. Here can be heard the rich country accents and the charm-ing place names which roll so easily from the tongue and create, almost in themselves, an impression of the kind of places they are—such names as Chalvington, Maynards Green, Cross-in-Hand, Burwash, Hurst Green, Cran-brook, Headcorn, Appledore, Woodchurch, Stone-in-Oxney suggest apple blossom, green fields, fragrant honeysuckle and ripening corn all in their season.

At Burwash, which has one of the prettiest village streets in the county and where the oldest Sussex iron grave slab is preserved in the churchyard, a path through the yard of the Bear Inn will bring you to " Bateman's," a charming Tudor house set in a valley among wooded hills, the former home of Rudyard Kipling.

East again via Etchingham and Hurst Green and over the border into Kent via Hawkhurst and Rolvenden brings us to Tenterden which can claim to be the only borough in the Weald. Tenterden is small but its history as a borough goes back to 1449 when Henry VI granted a charter of incorporation and the town joined the Cinque Ports as a " limb of Rye." This was undertaken to help Rye which at that time was impoverished owing to the failure of its fishing industry and because it had been sacked and burned by the French in the previous year and was, in consequence, unable to provide its contribution towards the 57 fighting ships to maintain free navigation in the English Channel. Tenterden was, however, flourishing as a prosperous centre for the woollen trade and, by its incorpor-ation, became responsible for supplying one ship, 21 men and a sum of £4 per annum in exchange for which it received, among other rights, the privilege of sending two barons to attend coronations in London. At that time Tenterden had its shipbuilding yards at Smallhythe which lies a short distance to the south. Their outline is still discernible and here too is Smallhythe Place, a fine Tudor house which once overlooked the sea, nowadays some eleven miles away. The house is a museum containing personal relics of Dame Ellen Terry who lived here.

St. Mildred's Church at Tenterden has a splendid west tower which rises to a height of 129ft about which a legend, although discredited by modern historians, is still often repeated. It is that the island of Lomea once owned by Earl Godwine, became the property of the Abbot of S. Austins who owned Tenterden Parsonage. The abbot became so obsessed with the idea of building St. Mildred's magnificent tower that he failed to keep the island sea-wall in repair so that the sea broke through and the island was lost, to become known as the Goodwin Sands which can





High Street, Tenterden, and St. Mildred's Church; and (below) a view of Cranbrook, Kent

The Sub-Area Headquarters, "Westlords," Willingdon Road, Eastbourne

still be seen from here when uncovered by the sea at low water. Believe the story if you wish, but better still spare a while, if you are passing, to see the church and you will not have wasted your time.

In East Sussex and South West Kent there are the areas which used to be known as the Black Country of the South. Ordnance survey maps of the Weald of Kent and Sussex show large areas of woodland and many streams, rivers and lakes. Three hundred years ago this now pleasant countryside was the centre of the iron producing industry of England. The red iron ore outcropped in many places where fuel and water were handy. The fuel used was forest timber which was then in plentiful supply and practically covered the countryside. Associations with the iron industry have been handed down as place names such as Furnace Wood, Furnace Farm, Furnace Mill, Furnace Hill, Furnace Pond, Gun Hill, Gun Green and Ordnance Place. At the time of the Civil War there were 27 furnaces and 42 forges and iron mills operating in Sussex. Later there were many more. Water power was extensively used to drive the bellows of the furnaces and the hammers of the forges and to enable the work to be extended beyond the times when the streams were in full flow, dams were built to provide storage lakes in addition to the many smaller headwater ponds at the mills. Examples of these larger lakes remain at Ashburnham, Eridge, Wadhurst, Horsmonden and Bedgebury Park.

Early Ordnance Production

At Horam the first wrought iron cannon was forged and Waldron Gill, a headwater of the Cuckmere River which rises just to the north flows southwards through Horam. Hadlow Down and Buxted are on the headwaters of the Ouse in Ashdown Forest. Near here is Huggetts Furnace and Five Chimneys and it is held that the first iron ordnance was cast in this vicinity. A little to the east lies Mayfield on the River Rother which rises at Rotherhurst, within half a mile of the source of the Rivers Ouse and Medway. At Mayfield will be found Ordnance Place which was connected with the manufacture of early armaments. Beyond Crowborough to the north is Eridge with its well-known castle and extensive lakes. Near the railway station is Forge Farm and to the south is Blackdon Mill and Redgate Mill Farm. Near Hammerwood and Holtye on the borders of Kent and Sussex is Furnace Wood and Furnace Pond on the stream of Eden Brook.

During the reign of Charles II there were about 50,000 workmen employed in the ironworks apart from those engaged in cutting and hauling timber for fuel. To give some idea of the rate at which the timber was being consumed it is known that in two years (1547–49) two mills alone used 2½ million cubic feet of wood. An Act of Parliament was passed in 1553 prohibiting the felling of oak, beech and ash trees for fuel within 14 miles of the sea or any navigable river or stream and later in 1583 another Act restricted the number of iron mills and prohibited the use for fuel of timber trees larger than one foot across at the base. With the discovery of coal and iron ore together in the Midlands the industry slowly dwindled away and the last furnace, at Ashburnham, was closed in 1811.

It is a far cry from those enchanting days of past history with their comparatively simple methods of production. Nowadays with everyone, and not least the people in the rural areas, demanding more and more electricity to help them with their work, in their homes and to enjoy their leisure hours it is difficult to appreciate to what extent heavy manual work and drudgery occupied the lives of the inhabitants of our country at that time. But in this part at least are to be found fine examples of the people's past industries and mode of life and by contrast there is in East Sussex and South West Kent to-day an area mainly made up of seaside resorts, residential areas and agricultural and horticultural land. There are no heavy industries here of the kind usually associated with the term and few light industries with the exception of those in and around Tonbridge and of the gypsum mines at Mountfield, near Battle.

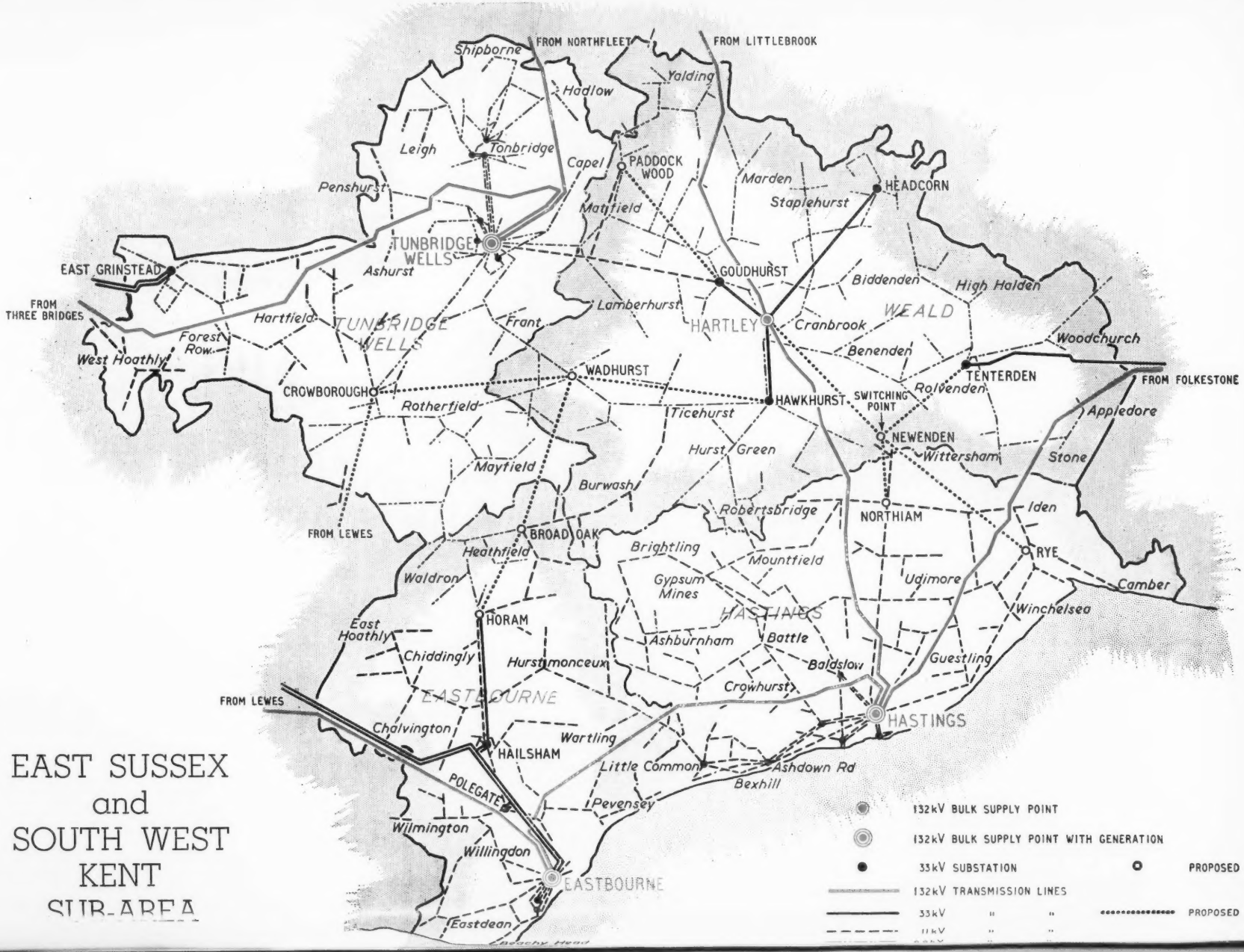
This then is the kind of country with which the Sub-Area is concerned in supplying electricity. The densely populated places are the seaside towns on the southern coastline and to the north west where with East Grinstead and Tonbridge we have, of course, the Borough of Royal Tunbridge Wells where Beau Nash arrived from Bath in 1735 to be master of ceremonies and where there is a chalybeate spring in the picturesque raised parade known as the "Pantiles." In between these two groups of towns there is a large area of farmland and woodland making a total of about 800 square miles in which there were 132,547 consumers at 31st March, 1954, i.e., an average of 166 consumers per square mile.

Progress Since Vesting Day

At vesting day there were 110,027 consumers who were supplied by seven separate electricity supply undertakings of which six were local authorities and one was a company undertaking as follows:—

Eastbourne Corporation	23,011	consumers
Bexhill Corporation	8,564	,,
Hastings Corporation	30,923	,,
Tunbridge Wells Corporation	16,021	,,
Tonbridge U.D.C.	6,513	,,
East Grinstead U.D.C.	3,368	,,
Weald Electricity Supply Co., Ltd.	21,627	,,
Total	110,027	,,

The number of consumers, therefore, has increased, during the six years since the industry was nationalized, by 22,520 or 20·5 per cent. In 1953–54, 316¼ million kWh was sold—an average of almost 2,400 kWh per consumer. This compares with 229½ million and an average of approximately 2,000 kWh per consumer in 1948–49.



EAST SUSSEX and SOUTH WEST KENT SUB-AREA

General view of silo and farm buildings at Buckhurst Farm, Withyham, Sussex

An analysis of the consumers at 31st March, 1954, into the various types and classes is as follows:—Domestic, 113,929; commercial, 14,436; industrial, 1,389; farms, 2,753; traction, 1; public lighting authorities, 39; total, 132,547. The overwhelming emphasis then is on the domestic consumers who make up almost 86 per cent of the total. There are about 4,200 farms in the Sub-Area of which 2,753 or 65·5 per cent were supplied with electricity at 31st March, 1954. Over 1,000 farms have been connected since vesting day.

A scheme for the reorganization of the Districts within the Sub-Area was brought into operation on 1st April, 1951. This provided for the grouping and merging of the seven original Districts and resulted in the formation of the four major Districts indicated on the map opposite. Hastings and Bexhill were amalgamated to form the present Hastings District which now has 45,226 consumers. East Grinstead and Tonbridge together with a portion of the former Weald District joined Tunbridge Wells District which now has 38,628 consumers. Eastbourne District was extended northwards as far as Heathfield and it now has 31,478 consumers. This leaves a much reduced Weald District with 17,215 consumers. They are all " single-headed " organizations.

The District offices and showrooms are at Eastbourne, Hastings, Tunbridge Wells and Hawkhurst and there are other showrooms at Bexhill, Rye, Heathfield, Crowborough, East Grinstead, Southborough, Tonbridge and Tenterden, making twelve showrooms altogether. Consumers can pay their accounts at any of these showrooms or they can, if they so desire, post remittances directly to the Sub-Area headquarters.

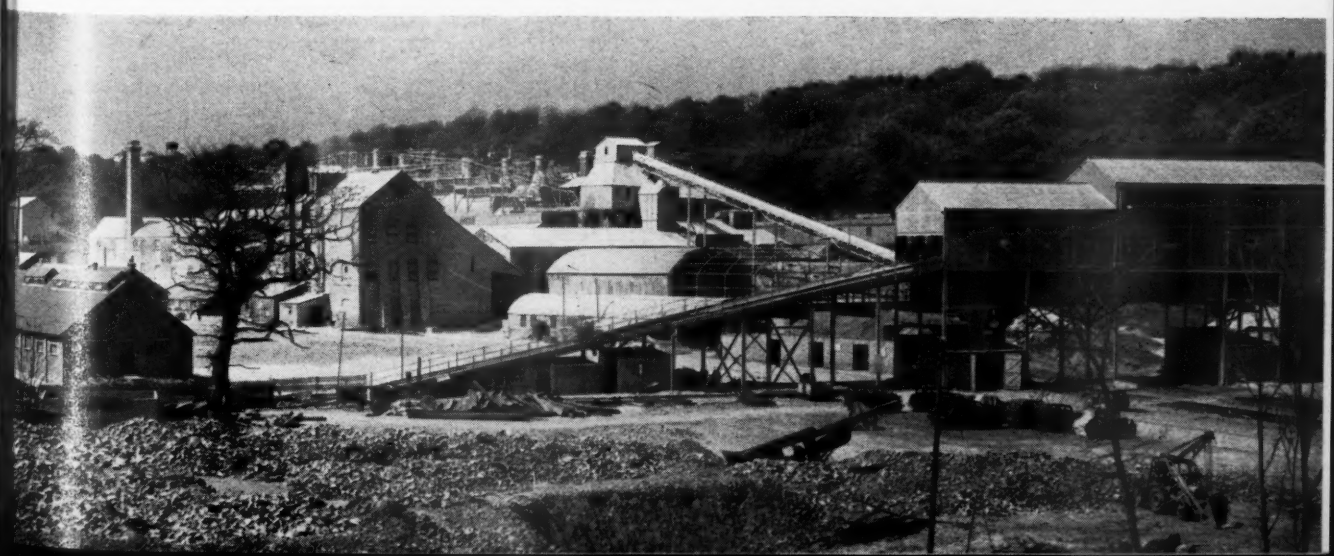
Income from the sale of electricity last year amounted to almost £2,300,000 and, instead of seven original billing points, consumers' accounts are now prepared by machines at and dispatched from " Westlords." Previously, expenditure costing was done by manual methods and was very elementary and, in some cases, practically non-existent. Now, this is done centrally at the Sub-Area headquarters by an up-to-date Powers–Samas punched card installation.

The outstanding amenities of the Sub-Area largely determine the type of consumers and the potential electrical development which may be expected. The prominence of the domestic load is the most noticeable feature when reviewing consumers. The holiday aspect is reflected by the large number of hotels ranging from the imposing and renowned Grand Hotel, Eastbourne, to the smallest hotel and so on to boarding houses and the " bed and breakfast " accommodation offered, not only on the coastal belt but throughout the Sub-Area which is so rich in scenery and other attractions for the holiday maker. This feature helps in building the summer load and produces a higher load factor than that which may usually be anticipated from a predominantly domestic locality. The domestic load is well developed, the cooker saturation figure being of the order of 35 per cent, and the water heating load is developing satisfactorily.

It is natural that the area has not developed industrially to any appreciable extent, indeed there is often keen resistance to the acquisition of sites for industrial purposes from local authorities and residents who are anxious to retain the attraction value of the area from a holiday and residential viewpoint. It may be said that the basic industry is farming in its various phases and much effort has been made to develop this type of load. There are, however, many interesting industrial applications, from the light industries built up in urban areas to such consumers as the Gypsum Mines, Ltd., which consumes some six million kWh per annum. Examples of industrial consumers are given below but as farming is so important it is fitting that some details of the development of farm load should be given first.

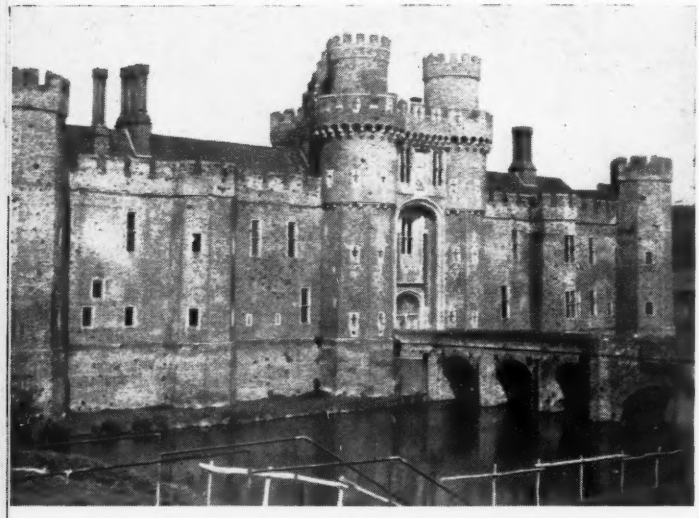
The dairy farm is the backbone of Sussex farming industry and many examples of electrically developed dairy farms are to be found in the Sub-Area. Hot water and steam for sterilizing is being increasingly provided by electricity. By developing the storage block type of equipment the load is controlled to a certain extent and peak loads which would provide technical difficulties on

General view of the gypsum mines at Mountfield, near Battle, Sussex



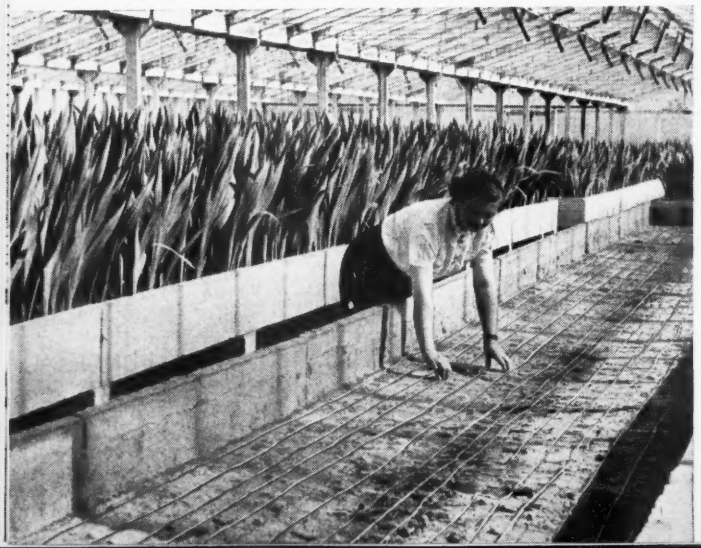
rural distribution networks as well as reductions in load factor are avoided. Grain storage is becoming increasingly important and the farmer who has sufficient drying and storage facilities is in a strong bargaining position. Many examples of various types of grain dryers have been installed; grass drying plants, too, are becoming more common and Sub-Area staff have been experimenting with a grass dryer suitable for the small farm. The drying load is very attractive, being of an off-peak nature.

The electrification of farms in East Sussex and South West Kent is well advanced and the problem is not so much one of connecting new supplies as improving the consumption of electricity and the load factors of farms already on supply. One example of thorough electrification is at Buckhurst Farm, Withyham, south west of Tunbridge Wells, where a wide range of machines demonstrates to the full advantages that the farmer can obtain from the wise and extensive use of electricity. Buckhurst Farm is a mixed farm carrying a milking herd of about a hundred Jerseys with their followers, a large acreage of grass and fodder crops, extensive pig and poultry holdings and some five hundred acres of corn. The dairy equipment comprises a 2 kW storage water heater, 9 kW sterilizing chest, 1½ h.p. direct expansion milk cooler and 1½ h.p. milking machine motor. A 90 h.p. grass dryer, pre-



Herstmonceux Castle, now the home of the Royal Observatory

Bench type hotbeds at Saxon Nurseries, Hankham, showing arrangement of soil-warming cables and in the background beds of early gladioli



breaker, mill and cuber deals with hundreds of tons of dried grass per season and the farm was the first to adopt bulk storage for cubes. The piggeries are of the Danish type and infra-red lamps are used with marked success to assist in the rearing of young pigs. Chickens are kept in a separate unit, a seven tier laying battery fitted with automatic feeding, cleaning and lighting being employed. Grain is dried and stored in an "in-silo" grain dryer of 350 tons capacity which also embodies a sack platform. The grain is pneumatically conveyed to the silos or to the granary where grinding is carried out by a small automatic hammer mill. The m.d. last winter was 31·5 kW and the consumption over 27,000 kWh for each of the summer quarters and 15,000 kWh for each of the winter quarters, giving a load factor of over 30 per cent.

Horticultural Applications

Another branch of farming which is potentially important from an electricity supply point of view is horticulture for the nurseryman is often quick to appreciate the advantages to be obtained. The Sub-Area has an increasing number of commercial soil warming and plant irradiation installations. As an instance of what may be achieved at a small nursery the following details are given of the Saxon Nurseries, Hankham, north west of Pevensey. The electricity supply was first connected in 1943 but apart from lighting, little use was made of it until 1946 when the owner's interest was aroused in the hot water treatment of bulbs and a bath fitted with immersion heaters was made up in the Eastbourne workshops. The next development of interest was the installation in 1949 of three hotbeds, each measuring 60ft long by 3ft wide and warmed by means of soil warming cables supplied from a 4·5 kVA transformer. These beds were run at 80 deg F and used for the forcing of amaryllis bulbs. Soil warming having proved successful, four bench type hotbeds were next installed in a cold greenhouse. Each bed measures 60ft by 5ft and is supplied from a central transformer. The loadings vary in each bed so as to give different conditions for various plants. One bed is used for rooting chrysanthemum cuttings and it holds 20,000 which can be raised at a cost for electricity of approximately £5. Other beds are used for French beans, gladioli and strawberries.

The sterilizing of potting soil is carried out by means of a 9 kW soil sterilizer which deals with 5 cwt each hour. The latest experiment is in the field of glasshouse ventilation. Four 5ft propeller fans have been installed in an effort to combat fungus diseases and so far this season the results have been most encouraging. The results of this ten year programme of electrification are seen in the annual consumption figures for the holding which increased from 17 kWh in 1943 to 30,720 kWh in 1953.

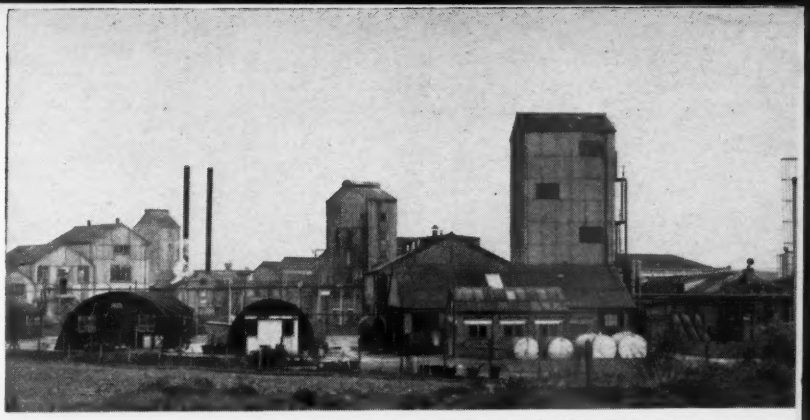
In the northern part of the Sub-Area there are many fruit farms and fruit storage installations are becoming common. These range from small storage bins up to large buildings requiring 200 kVA for the refrigeration plant. The storage plant at Paddock Wood owned by Hernden Farms, Ltd., may serve to indicate the importance of this type of demand. In this the installed horse power for refrigeration is 350. The storage capacity for apples is well over 2,000 tons. The annual consumption is over ½ million kWh of which over 80 per cent is taken at off-peak times. The annual load factor is 43 per cent, or if calculated on the chargeable demand it is 110 per cent. By an efficient automatic control the demand during the winter daytime is kept below 55 kW; it rises to nearly 150 kW during the night.

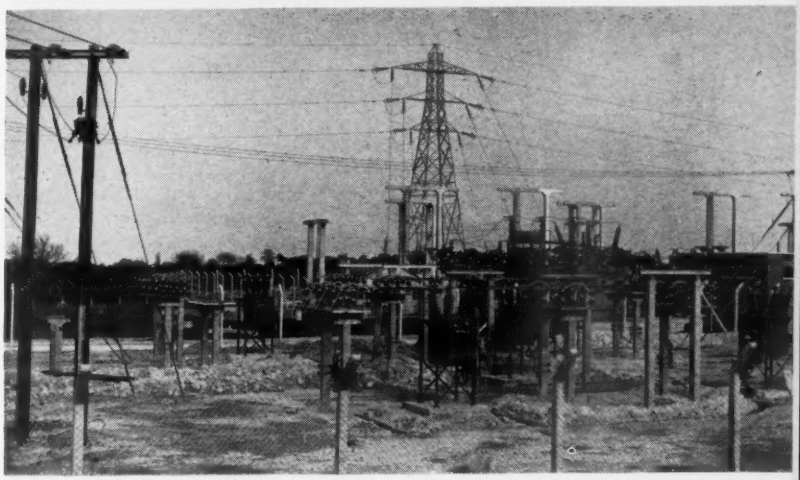
In another part of the Sub-Area there are extensive hopfields and the increasing use of electricity for hop picking machines and hop drying is another means of

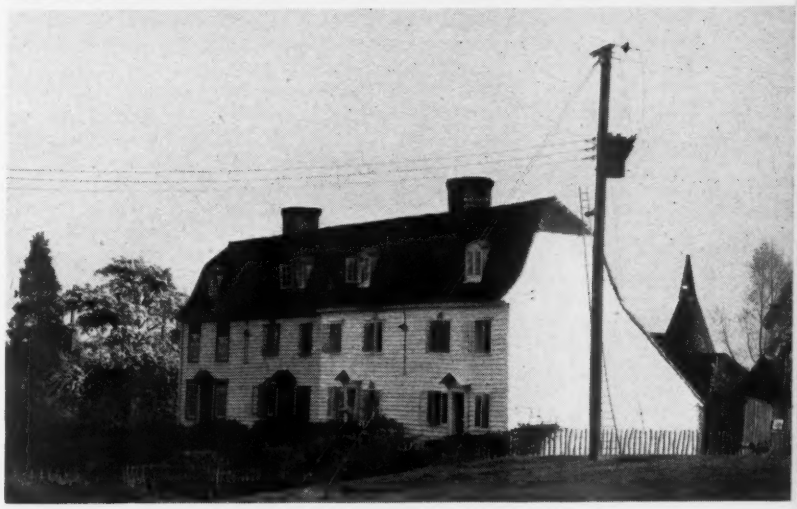
increasing consumption of electricity during the summer months. The most prominent of these fields are those at Bodiam of the famous Guinness firm.

Turning to industry, there are many interesting applications in the Sub-Area, the most important of which—the gypsum mines, near Battle—has already been mentioned. The mining of gypsum has become increasingly important since the war because of the heavy building programme. The product is an essential component of fine plaster, plaster board and similar materials. Since the war the mining operations have been completely mechanized; a supply of 2 MVA at 11 kV is afforded and the annual load factor is over 40 per cent.

The trolley-bus services in Hastings and Bexhill take a supply of nearly 2 MVA at 11 kV and this supply has a load factor of 40 per cent.







Top: A corner of an industrial site at Tonbridge, Kent, showing part of the plant of the Distillers Co., Ltd.

Centre: 132 kV bulk supply substation at Hartley, near Cranbrook, Kent, in course of construction

Bottom: Typical single-phase line and pole transformer on the road between Cranbrook and Tenterden, Kent

There are a number of interesting industrial consumers in Tonbridge, including the British Flint & Cerium Co. which produces, by means of electrolysis, the rare metal cerium from imported raw materials. This industry has developed since metallurgists found cerium an essential component for alloys used in the aircraft industry. Formerly the product was used solely for lighter flints. A supply of 500 kVA at a load factor of 60 per cent is provided. In the same locality are two chemical factories with a further factory at Yalding a few miles away requiring some 700 kVA in total. In one of these factories the Distillers Co., Ltd., carries out large scale experiments in the production of hydro-carbon derivatives. One of the earliest plants for the production of the now common insulation material p.v.c. was made here. Another factory, that of Plant Protection, Ltd. (I.C.I.), manufactures quantities of germicides.

One of the most interesting premises supplied is Herstmonceux Castle, now the National Observatory. The transfer of equipment from Greenwich and elsewhere is not complete and a further two years will be required before this is done. The consumption is likely in the future to be half a million kWh per annum and will be used for such interesting and novel applications as the movement of large telescopes.

There are several printing works in the Sub-Area and also millers, including the renowned Horsebridge Flour Mills of McDougalls, Ltd. Timber firms have factories in the area, some merely sawing and supplying the cut timber and others producing finished articles such as portable buildings. One such factory, that of Hall & Co., Paddock Wood, takes a supply of 250 kVA at a load factor of nearly 25 per cent. The factory occupies a site of 13 acres.

There are, of course, many hospitals in the Sub-Area but mention must be made of one, the Queen Victoria Hospital, East Grinstead. This hospital, as most people know already, specializes in plastic surgery. Many marvellous cures were effected during the last war and as a result this treatment has now become a most beneficial art. The hospital is afforded a 200 kVA supply at a load factor of over 40 per cent.

The area also has a number of radio and radar stations and the majority of these are excellent consumers from all points of view.

Street lighting is regarded as most important and the Board works in close co-operation with the lighting authorities in the Sub-Area for the promotion of good practice in this sphere. Representatives of the Board maintain close contact with the various borough surveyors

and many improvements in lighting have been effected. Experiments in new ideas for street lighting are continuously made and as an example, South Street, Eastbourne, was the first street to have 5ft fluorescent fittings affixed to the façades of buildings so avoiding any of the normal street furniture which can be a nuisance in narrow shopping streets. The original experimental installation is now permanent and many delegates to the Convention will no doubt view the street after dark.

The extent of the primary distribution system in the Sub-Area is indicated by the map on p. 1072. The following brief description of its more prominent features and of some of the general engineering activities will no doubt be of interest.

Supplies are taken from 132 kV bulk supply substations at Eastbourne, Hastings, Tunbridge Wells and Hartley. The last is a new tapping of the Littlebrook–Hastings 132 kV line near Cranbrook, Kent, and has been commissioned temporarily to provide a 6·6 kV supply, but construction work is proceeding and a permanent 33 kV supply will be available before next winter. There are small generating stations at Eastbourne, Hastings and Tunbridge Wells, with installed plant capacities of 9, 14·25 and 11·25 MW respectively. The maximum demand in February of this year was 122 MW.

The high voltage distribution system consists of 817 miles of cable and 431 miles of overhead lines operating at 33, 11, 6·6 and 2·2 kV; a 6·6 kV network covers Tunbridge Wells and Weald Districts and an 11 kV network covers Eastbourne and Hastings Districts. The 33 kV primary distribution is being developed to reinforce the 6·6 kV and 11 kV networks at various points and 33 kV substations are at present being constructed at Goudhurst, Hawkhurst and Headcorn.

In the towns of Eastbourne, Hastings and Tunbridge Wells, comprehensive 2·2 kV single-phase systems are supplied from Scott-connected transformer substations, the medium voltage distribution systems being single-phase three-wire, with the exception of Tunbridge Wells, where the two-wire network is gradually being replaced by three-phase four-wire distribution.

At Bexhill a d.c. to a.c. change-over scheme is in progress and 795 consumers were changed over during last year, leaving a further 1,385 consumers to be dealt with in the next two years. There are also a small number of d.c. consumers still remaining at East Grinstead and Tonbridge. At Hastings and Bexhill, 11 kV supplies are provided for the Hastings Tramways Co. at various points, where mercury arc rectifiers provide d.c. for the trolley-bus system.

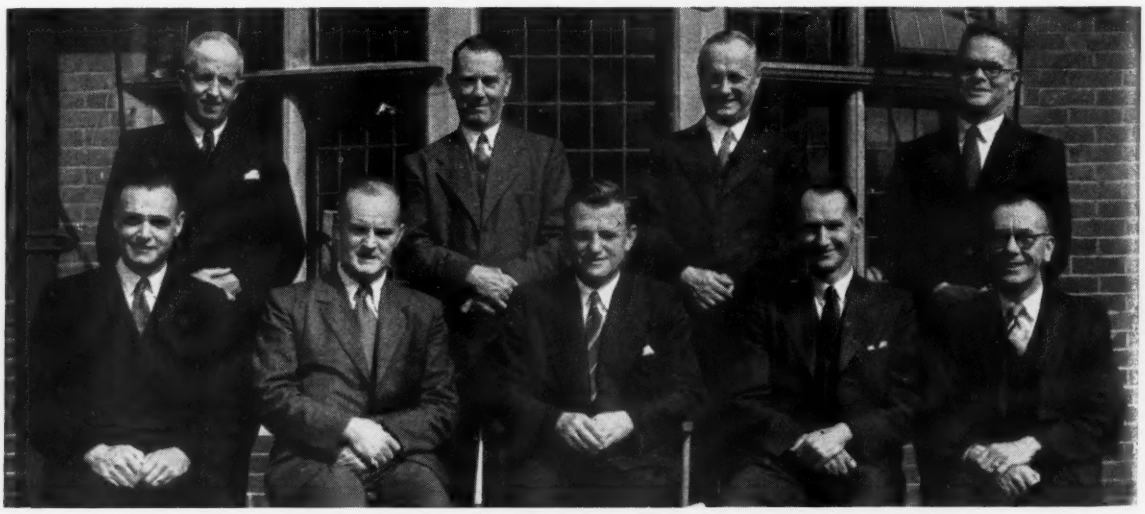
A jointing school was commenced in the Sub-Area and this has been very successful in improving the standard of jointing and also in the training of new jointers. It is intended to open an overhead line school in the near future. All Districts are equipped with high voltage testing equipment and fault locating apparatus, but additional and comprehensive equipment is permanently carried in a Sub-Area test van.

A cathodic protection installation has recently been commissioned at Eastbourne, to prevent further corrosion of plain lead sheathed cables in an area of the town where the nature of the soil water had caused electrolytic currents in the cable sheaths.

Since vesting day, all construction work in the Sub-Area has been carried out by direct labour, and all high voltage overhead lines have been erected in accordance with, or based on, B.S. 1320. A pole hole boring machine has been in continuous use during the last twelve months, and this has helped considerably to speed up the erection of overhead lines. By the end of this year there will be no villages in the Sub-Area without electricity supply, and the remaining scattered farms and houses are being connected at a rate consistent with the economics of the case.

* * *

The guide books issued by the local authorities in this part of the country are many and colourful. To believe all that is written and illustrated in them would leave no doubt whatever in the mind that hereabouts there are ideal places in which to live and earn one's living. To a very large extent this is true but the fundamental principles of supplying electricity to all and sundry and of meeting all their electrical requirements are very similar whatever the locality. At present there is a steadily increasing demand for the product of our industry and a growing belief in and an understanding of the uses to which it can be put which augurs well for the future. This article has been written in an attempt to illustrate the various kinds of demands received in this locality and how they are being satisfied.



Principal officers of the East Sussex and South West Kent Sub-Area

Seated (left to right): Mr. F. S. Jones, secretary; Mr. G. H. Ingamells, commercial officer; Mr. N. Boydell, manager; Mr. P. H. Taylor, engineer; Mr. E. S. Patterson, accountant. Standing: Mr. J. E. Winborne, manager, Eastbourne District; Mr. G. C. B. Everard, manager, Hastings District; Mr. F. Springate, deputy manager, Tunbridge Wells District; and Mr. W. J. Collins, manager, Weald District. (Mr. T. W. Dann, manager, Tunbridge Wells District, was unavoidably absent when the photo was taken)

1. Railway Station.
2. Town Hall.
3. Winter Garden.
4. Grand Hotel.
5. Pier Ballroom.

Aerofilms, Ltd.

Business Proceedings and Social Events at Eastbourne

The Convention Programme

NEXT Monday the sixth British Electrical Power Convention opens at Eastbourne under the presidency of Mr. J. R. Beard, whose portrait appears in this issue. Twenty-five associations or groups are represented by the Convention which is governed by a Council whose members are given below. Sir Harry Railing is the vice-president; the past presidents are Lord Citrine, P.C., K.B.E., Companion I.E.E., Sir Vincent de Ferranti, M.C., M.I.E.E., Sir Henry Self, K.C.B., K.C.M.G., K.B.E., Companion I.E.E., Mr. P. V. Hunter, C.B.E., Hon. M.I.E.E., F.A.I.E.E., and Sir John Hacking, M.I.E.E.

Members of Council	Representing
Mr. J. R. Beard, C.B.E., M.Sc., M.I.C.E., M.I.E.E., F.A.I.E.E.	Association of Consulting Engineers.
Mr. C. T. Melling, M.Sc.(Tech.), M.I.E.E., M.I.Mech.E.	British Electrical and Allied Industries Research Association.
Col. B. H. Leeson, C.B.E., T.D., M.I.E.E.	British Electrical and Allied Manufacturers' Association.
Sir Henry Self	British Electrical Development Association.
Lord Citrine	British Electricity Authority and Area Boards.
Mr. W. N. C. Clinch, M.I.E.E.	"
Mr. L. Howles, C.B.E., M.I.E.E.	"
Mr. W. S. Lewis, C.B.E., J.P., Companion I.E.E.	"
Mr. H. Nimmo, C.B.E., M.I.C.E., M.I.Mech.E., M.I.E.E.	"
Mr. V. A. Pask, M.I.Mech.E., M.I.E.E.	"
Mr. S. F. Steward, C.B.E.	"
Mr. E. G. Batt.	British Refrigeration Association.
Mr. J. M. Storey, M.I.Mar.E.	British Valve Manufacturers' Association.
Sir John Dalton, A.M.I.E.E., F.C.I.S.	Cable Makers' Association.
Mr. W. J. Jones, M.Sc., M.I.E.E.	Electric Lamp Manufacturers' Association.
Mr. V. W. Dale, Companion I.E.E.	Electric Vehicle Association of Great Britain.
Dame Caroline Haslett, D.B.E., J.P., Companion I.E.E.	Electrical Association for Women.
Mr. L. C. Penwill, C.B.E., Companion I.E.E.	Electrical Contractors' Association.
Lt.-Col. J. L. Drummond, M.C.	Electrical Contractors' Association of Scotland.
Mr. A. B. Wildsmith.	Electrical Wholesalers' Federation.
Mr. A. M. F. Palmer, A.M.I.E.E., M.P.	Staff Associations' Committee.
Mr. T. G. N. Haldane, M.A., M.I.E.E.	Institution of Electrical Engineers.
Mr. R. Birt, B.Sc., M.I.E.E., M.I.C.E., M.I.Mech.E., F.C.I.S.	National Register of Electrical Installation Contractors.
Mr. A. W. Ferguson, M.C., C.A.	Electricity Undertakings in Northern Ireland.
Mr. K. J. McKillop.	Water-Tube Boilermakers' Association.

In addition to the organizations mentioned the following are members of the Convention:—North of Scotland Hydro-Electric Board, Isle of Man Electricity Board, Jersey Electric Co., Ltd., and States of Guernsey Electricity Department.

DETAILS OF ARRANGEMENTS

MONDAY, 14th JUNE

10.30 a.m.–12.30 p.m. *Pier Ballroom.* Mayoress of Eastbourne's Coffee Party for Ladies.
1 p.m. *Drive Hotel.* Eastbourne Rotary Club Luncheon.
8.30 p.m. *Winter Garden.* Official opening of the Electrical Exhibition by the President, Mr. J. R. Beard.

TUESDAY, 15th JUNE

10 a.m. *Winter Garden.* Opening of Convention. Civic Welcome by His Worship the Mayor of Eastbourne. Presidential address by Mr. J. R. Beard.
12.15 for 12.30 p.m. *Grand Hotel.* E.A.W. Luncheon.
2.30 p.m. *Winter Garden.* Paper "Electrical Engineering in World Trade" by Sir George Nelson, F.C.G.I., M.I.Mech.E., M.I.E.E., Chairman and Managing Director, English Electric Co., Ltd. Discussion to follow.
3–5 p.m. *Pier Ballroom.* Ladies are invited to take tea with Mrs. Beard. There will be a dress fabric show during the afternoon.
8–8.30 p.m. *Winter Garden.* Reception by the Mayor and Mayoress of Eastbourne, followed by a Dance.

WEDNESDAY, 16th JUNE

10 a.m. *Winter Garden.* Papers "Modern Lighting for Industry, Commerce and the Home" (with demonstrations) by Mr. W. J. Jones, M.Sc., M.I.E.E., Director, Electric Lamp Manufacturers' Association; "Electricity in the Modern Home" (with demonstrations) by Dame Caroline Haslett, D.B.E., J.P., Companion I.E.E., Director, Electrical Association for Women. Ladies are especially invited to this session. The Golf Competitions will be held during the day.

THURSDAY, 17th JUNE

10 a.m. *Winter Garden.* Paper "The Development of the Domestic Electricity Load at Home and Overseas" by Mr. D. Bellamy, O.B.E., D.L., F.A.C.C.A., F.C.W.A., Companion I.E.E., Chairman, Yorkshire Electricity Board. Discussion to follow.
2.30 p.m. *Winter Garden.* Paper "The Comparison of Installation Practice at Home and Overseas" by Mr. S. L. M. Barlow, Assoc. I.E.E., M.A.I.E.E., Past-President, Electrical Contractors' Association. Discussion to follow.
7 for 7.30 p.m. *Grand Hotel.* Annual Dinner.
8 p.m.–12.30 a.m. *Winter Garden.* Dance. The "Lady Citrine" and "G. P. Dennis" Trophies will be presented to the winners of the Golf Competitions at approx. 11 p.m. Cabaret to follow.

FRIDAY, 18th JUNE

10 a.m. *Winter Garden.* Electrical Forum.
12 noon. *Winter Garden.* Annual General Meeting and conclusion of Convention.

Convention Exhibition

A PREVIEW OF EQUIPMENT ON SHOW AT EASTBOURNE

ALTHOUGH it cannot claim to be the largest electrical exhibition held, the display arranged at Devonshire Park, Eastbourne, in conjunction with the British Electrical Power Convention can perhaps at least claim to be the most representative and certainly it comprises the most comprehensive annual collection of domestic appliances. The exhibition is open from 10 a.m. to 6 p.m. on Monday and Tuesday, from 10 a.m. to 9 p.m. on Wednesday and Thursday and from 10 a.m. to 4 p.m. on Friday. The general public is admitted on Wednesday, Thursday and Friday.

The importance of the kitchen as the housewife's workshop has always been appreciated by the Electrical Association for Women which draws special attention to its kitchen re-planning competition, now being held among its members and students from affiliated schools. The competition is designed to provoke an even wider interest in kitchen design and to encourage careful thought in planning and discrimination in the choice of equipment. Kitchen equipment is a Hotpoint speciality and examples shown include a sink unit finished in cream porcelain enamel, mixer taps, wall mounting cabinets, and a " Vecta " fan.

Cookers are well to the fore. An entirely new Tricity cooker (illustrated), priced between the larger " Queen " and the popular 528, has several interesting features which will give it an exceptionally wide appeal. The English Electric automatic cooker, model 2011, shown in white and mushroom grey, incorporates a plug-in auto-control panel modified to carry an independent switch for the 13 A socket outlet. The Revo " Monarch " cooker now in full production has a one-piece welded construction, with a tall splash back carrying eye-level switches, full depth hot-cupboard and grill chamber, large oven with three-piece removable interior, two 8in boiling plates and a large grill boiler.

A comprehensive range of cookers seen on the Simplex stand includes the new " Creda Star " models 305 (illustrated) and 310; the " Super Comet," the cooker with time switch, clocks and dials; the " Comet," and the " EV.13 " cabinet type cooker. Despite its competitive price, the " Creda Star " possesses a very large oven, 8in and 6¼in boiling plates (6¼in plate not included in model 305) and a grill boiler. The oven and 8in plate are automatically controlled as standard, all controls being at waist height. An extended hob available as an extra on model 310 is complete with towel rails. A large turntable displays the full range of Belling cookers, including the " Streamline-de-Luxe " model, standard models with inner glass doors, and " Baby " cookers. The " Royal " is a prominent Falco cooker.

The new B.N.E. " C.90 " cooker (illustrated), a development of the " C.49," incorporates the " Speedheat " oven which, with a loading of only 2,500 W, cuts pre-heating time by half and reaches 400 deg F in twelve minutes. Another new feature is a " Pyrex " glass casserole grill/pan.

The Jackson " Two-Ninety " cooker embodies a number of new features which, in conjunction with its low price, make it particularly suitable for housing estates and hire-purchase schemes. Both the 194J and 192J " Clear-view " cookers have inner glass doors, " Cleanlite " cream splash oven interiors and independently heated drawers for keeping plates, dishes and food hot.

The competition between solid and radiant type boiling plates still continues. In the new Backer type " 8.MC " radiant plates (illustrated) a multicoil element carries two separate circuits within the one " Inconel " sheath. Apart from other boiling plates made by this company to E.D.A. and American patterns, there are such industrial heating elements as oven elements, infra-red heating units, incinerator elements, etc., and also a new thermostatically controlled immersion heater.

New techniques have enabled the loading of the 8in G.E.C. radiant hotplate to be increased from 1,600 W to 1,800 W. The " Redring Delta " radiant plate brought out by " Metrovick " facilitates the use of two utensils side by side on an 8in plate. The two " D " shaped elements can be energized either separately or both together. The new " Redring " boiler-griller gives improved boiling performance, while only one of the new inexpensive finned sheathed elements is required in the base of the oven to give uniform heating and quick heat response, the majority of the heat being transferred by convection. This single element simplifies cooker design and allows substantially more cooking space for a given oven size. The new black ground base Hague & McKenzie " Pyramid " utensils are specially designed for use on radiant hotplate cookers.

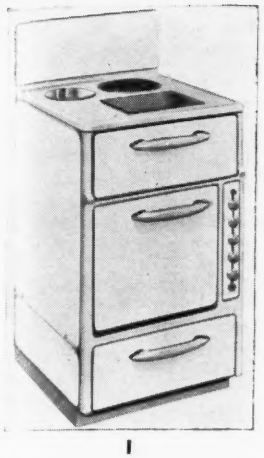
The removal of restrictions on the use of nickel is reflected in the restoration of the complete range of chromium-plated kettles (illustrated), coffee percolators, urns and toasters made by Bulpitt & Sons, Ltd. Representing other products of this company are fires, wash boilers, hollow-ware, glue pots, heating pads and blankets. The new Falk Stadelmann " Teatime " kettle (illustrated) is fast and even pouring and easy to fill. It is available in polished aluminium or chromium-plated finish, with loadings of either 1,000 W or 1,500 W. The Premier No. 2839 " Pylon " kettle has now been replaced by No. 2939 (illustrated), the difference being in the handle design which now has chromium-plated brackets.

Almost instantaneous percolation is obtained in the new Best Products No. 2 coffee percolator (illustrated), by the use of a double jacket fitted at the base of the coffee box stem, which thermally insulates the water surrounding the immersion-type heating element. Percolation is pre-set, with infinite variations, giving complete control of flavour. A red light indicates when the percolator is switched on, a green light showing when the coffee is made and is merely keeping hot.

Among Hotpoint small appliances are a coffee percolator, a toaster, a kettle, a warming plate, 1 kW and 2 kW fires and an electric blanket, while a plate warmer and a food mixer with mincer and juicer attachments are among English Electric portable appliances. Thermat electric blankets and pads include the latest model with the floral sateen cover. For those who have not yet been convinced of the merits of electric shaving, facilities are given on the Philips stand for visitors to try out the " Philishave " dry shaver (illustrated) themselves. The new Chilton universal shaver conversion kit contains, in an attractive presentation case, not only the transformer-adaptor with interchangeable British, Continental and American flat pins but also three other adaptors. New Smith's " Sectric " clocks include the " Grenfell " (illustrated) in a hand-finished brass case and walnut finish case with polished brass figured zone mounted on a silver grained background. Ferranti clocks in attractively designed moulded plastic and wood cases are available in colours and finishes to suit every taste.

Apart from modifications due to the necessity to conform to the new B.S. regarding guards, many new fires are making their appearance. Outstanding among a display of Ferranti floor panel and wall fires of contemporary design are parabolic reflectors, elements designed to give the highest possible temperature, and guards which incorporate features which, although not required by the British Standards specification, further add to safety.

New Belling fires not yet seen generally by the trade include the " Radiant-Convector " which has a 1 kW radiant unit inset in the base and a retractable towel rail enabling



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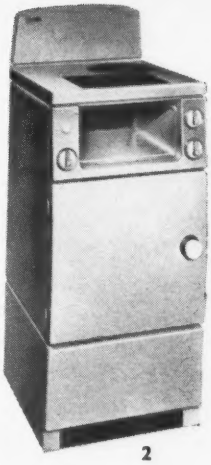

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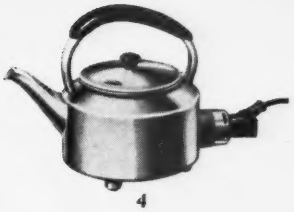

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clothing to be dried and aired above the convection currents. There are also two new portable fires, the "Dainty" and the "Modern" as well as the new "Cheery" imitation coal fire (illustrated). A contemporary styled screen heater is to be seen among a range of Premier fires.

Berry's "Raydair" heaters have now been further developed and three models with variable thermostats have been introduced in place of the original patterns with pre-set thermostatic cut-outs. In addition there are two new designs, the "Raydair" greenhouse heater and the "Raydair" industrial heater. In common with the new range of period fires a particularly realistic "Berrylog" fire, the "Alderberry," is equipped with a modified heating system which adds considerably to the appearance and efficiency. Larger and smaller versions of the G.E.C. "Nightstor" storage space heater have loadings of 2·25 kW and 1 kW respectively.

The Thermovent "FR" convection heaters (E. K. Cole, Ltd.) incorporate a new duct and element system which has resulted in a considerable increase in the circulation of air through the heater and a still lower outlet grille temperature. Although primarily intended for commercial and industrial applications, the "SR" models (illustrated) are so attractively styled that they are also suitable for domestic use. Thermovent inset models are available for building

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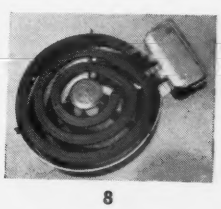

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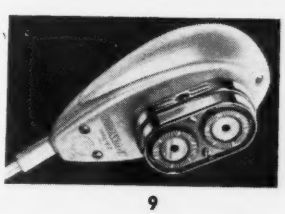

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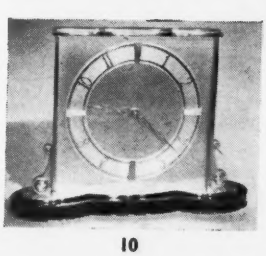

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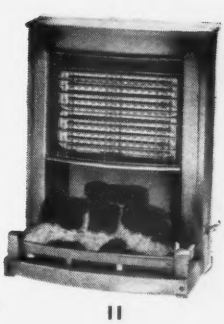

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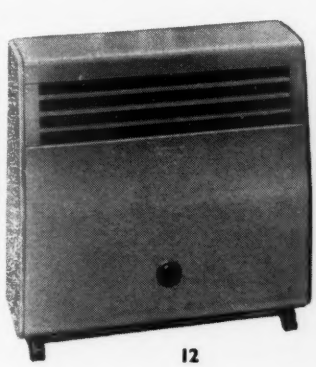
(1) B.N.E. "C.90" cooker. (2) Simplex "Creda Star 305" cooker. (3) Tricity "Queen" cooker. (4) Premier "Pylon No. 2939" kettle. (5) Bulpitt "Royal" kettle. (6) Falk Stadelmann "Teatime" kettle. (7) Best No. 2 coffee percolator. (8) Backer type 8.MC boiling plate. (9) Philips "Philishave" dry shaver. (10) Smith "Grenfell" clock. (11) Belling "Cheery" fire. (12) Thermovent "SRC.2" convection heater. (13) The cases of these Dimplex 1½ and 1¼ kW oil filled radiators are now cast in one piece. (14) Hurseal portable oil filled radiator



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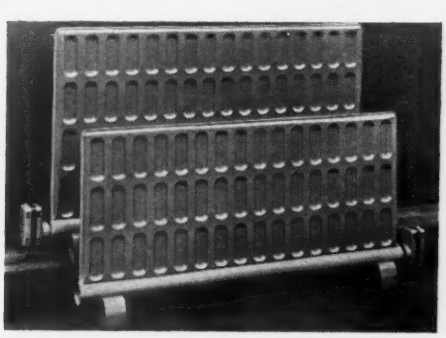

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into walls, partitions, furniture, etc. " Radiant Glass Thermo-panels " have special safety features.

Oil filled radiators continue to increase in popularity. The eight panel and two column type Dimplex models (illus. p. 1079) are available in colours and can be fitted with feet, castor wheels or wall brackets. An improved type of thermostat is now incorporated. Detachable towel rails are supplied for some models. Special flameproof and gas-tight radiators have been produced for installation in spray booths, garages, hospitals, etc. The new Hurseal " TV Popular " radiator (illus. p. 1079) is now on the market and the company is also introducing a wide range of models with thermostatic control incorporated. Accompanying these heaters are oil filled electric towel rails, a warm air heater, room thermometers, washable electric bedsheets and thermal insulation materials. An aerial photograph superimposed with models of various buildings illustrates the advantages of " Panelec " floor heating arranged for off-peak operation.

Most of the water heater manufacturers now produce apparatus specially designed to meet the requirements of the Electricity Boards for long term hire-purchase schemes. Besides its immersion heater (illustrated) with two sheathed wire elements giving a low watts density element and easy wiring terminal box on the side of the head, Geo. Bray & Co., Ltd., have brought out a much cheaper type of heater, in which one element only is used with a simple cover having mains connections direct to the thermostat and element. This company also shows various metalclad ceramic embedded heating elements and precision made electro-ceramic insulators.

Produced to meet the demand for a simpler and lower-priced immersed-type thermostat with fixed temperature setting and capable of being withdrawn without draining the hot water system, the new Sunvic TQB water heater thermostat is only $5\frac{3}{4}$in long. The standard setting is 140 deg F, but settings of 160 deg F and 180 deg F can be supplied. The TQA stem type water heater thermostat is also on view, together with one-circuit radiant boiling plates and " Simmerstats," and the TO oven thermostat.

The new " Sadia Select " 3 gal water heater, which is rectangular in shape, fixes flush to the wall and has an overall projection of only $7\frac{3}{4}$in. The four colours available, white, parchment, pastel green and blue, blend with any kitchen. The " Aidas Dumpy " immersion heater with only $1\frac{3}{4}$in cover projection fits easily into confined spaces where fixing is sometimes very difficult. Berry's water heating apparatus is represented by the " New Look " storage heater and a range of very competitively priced immersion heaters, while small thermal storage water heaters embodying a number of new and interesting developments are shown by Santon, Ltd., together with dual controlled immersion heaters, lagging jackets, etc. Although the main emphasis of the Heatrae exhibit is on domestic water heating, a selection is shown of new Buxton Certified heating equipment which includes immersion heaters and gilled tube air warmers (illustrated).

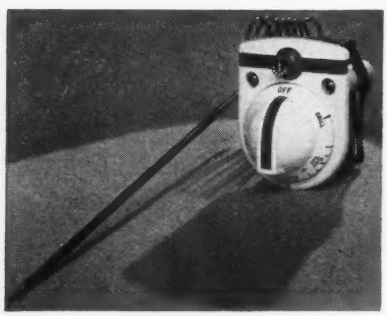
To the " Creda Redhead " immersion heaters has been added a series of non-automatic heaters fitted to $1\frac{1}{2}$in B.S.P.T. heads which meet the demand for competitively priced units for use with separate thermostats. With them are the new " Creda Contour " $1\frac{1}{2}$ and $2\frac{1}{2}$ gal water heaters, together with a " Creda " double purpose water heater. The new basic range of G.E.C. automatic immersion heaters with $2\frac{1}{4}$in B.S.P.T. heads have many features designed to aid the wireman.

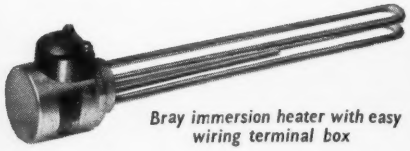
Hotpoint sheathed wire heating equipment includes " Torribar " immersion heaters for use with integral or separately mounted thermostat controls. The " C.F. " heater incorporating a fixed setting thermostat can, in common with the " C.D." heaters of 27in length, be re-formed on site with a special bending tool. " Torribar " radiant boiling plates are also shown. H. J. Baldwin & Co.'s wide range of heating elements, both in mica and ceramics, includes special elements made for the domestic appliance trade.

With thermostats for ovens (illustrated), water heaters and space heaters, the Rheostatic Co., Ltd., has a range of automatic temperature control devices suitable for central heating installations. Besides their normal range of thermostats for temperatures from 1,100 deg C to 0 deg C, Robert Maclaren & Co., Ltd., draw special attention to their new convector heater thermostat, their new water heater thermostat ceramic base and to a thermostat modified to make it suitable for controlling heated rollers. A working model demonstrates the operation of a float switch.

There is clearly a demand for the small heated washing machine for homes where space is limited. A prototype of one such machine is shown by Burco, Ltd., together with the " 10P " washing machine and two redesigned cabinet type wash boilers, the E.850, replacing the E.840, and the E.950 (illustrated), replacing the E.900; the latter incorporates a hand wringer. Another of the smaller types of machine without heater is the " Goblin W.114 " (illustrated) shown by the British Vacuum Cleaner & Engineering Co., Ltd. Although exhibiting their full range of " Servis " washing machines, refrigerators and rotary ironers, Wilkins & Mitchell, Ltd., draw particular attention to their new model " S " washing machine designed specially for use in the smaller kitchen. It does a full family wash and incorporates a low-geared hand wringer, a 2 kW heating element and a self-emptying pump. The de-luxe washer is available both with and without heater. Besides a power wringer and automatic draining pump the latest English Electric washing machine also incorporates a 3 kW immersion heater while another washer supplied if desired with a heater incorporated is the Parnall EW.50. The " Ezy-Press " plate type ironer (illustrated) of the same make further facilitates home laundry work.

Demonstrated with the Hotpoint CF/P washing machine is the " Rightweight " automatic iron which weighs only $3\frac{1}{2}$ lb and has a novel swivelling flex device. With three versions of the Hoover washing machine is the new steam-or-dry iron, while among already well-known irons is the Premier " Sylph " lightweight iron with a practically everlasting element. A new Revo heat controlled iron (illustrated) is of streamline design with chromium-plated body and sole plate and black moulded easy-grip handle which incorporates an easily detachable panel for access to the terminals and pilot lamp. The new H.M.V. " Milady's " medium-weight automatic iron (illustrated) has built-in

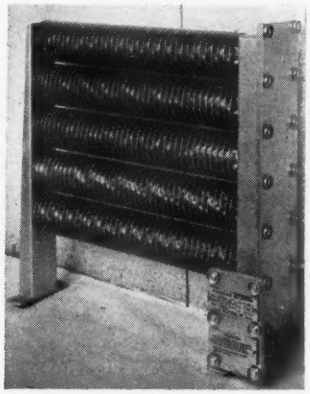


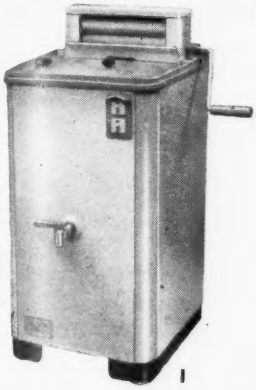


Bray immersion heater with easy wiring terminal box

Left: Rheostatic HRS cooker thermostat

Right: Heatrae five-tier gilled tube air warmer





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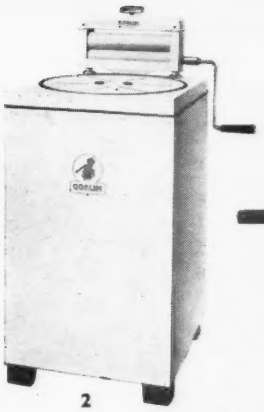

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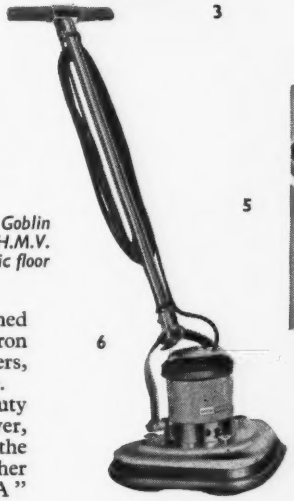

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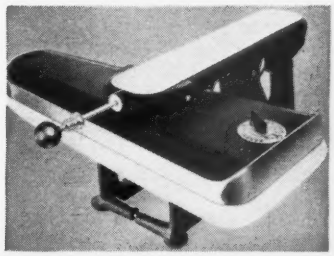

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(1) Burco E.950 wash boiler with wringer. (2) B.V.C. "Goblin W.114" washing machine. (3) Revo automatic iron. (4) H.M.V. "Milady's" iron. (5) Parnall "Ezy-Press" ironer. (6) Vactric floor polisher. (7) Hoover "Dustette"

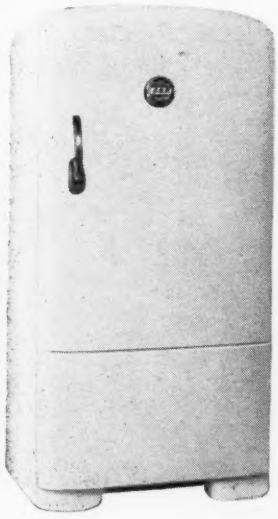
television and radio suppressors and an element designed to give an extra long life. With the Walter "No-cord" iron and board are a clothes dryer and airer, and also ozonizers, the industrial model of which is shown for the first time.

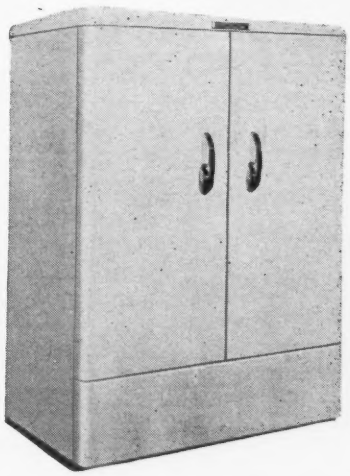
In addition to the standard model 612, the heavy duty model 912 and the "Junior" model 119 cleaners, Hoover, Ltd., shows its new model 417 cylinder cleaner, the "Dustette" hand-cleaner (illustrated), and the floor polisher and scrubber. Improvements to the G.E.C. "DM.310A" cylinder suction cleaner include radio and television interference suppressors, double insulation, paper dust bag, a flexible rubber crevice nozzle, and light weight extension tubes. An "inner air sleeve" dust bag is also a feature of the Hotpoint 411 cleaner. The Falk Stadelmann "Playfair" hand model vacuum cleaner is equipped with straight and bent extension tubes for dealing with the more inaccessible positions.

Besides vacuum cleaners of both upright and cylindrical types Vactric, Ltd., are showing their floor polisher (illustrated). With the Electrolux model "55" cleaner are the industrial model "33" and the model "B6" floor polisher. Both domestic and industrial types of vacuum cleaner are shown by British Vacuum Cleaner & Engineering Co., Ltd., together with such other products as "Teasmade" and "Tele-T" tea-making equipment, and the "Lumilarm" lamp and alarm clock.

The British Refrigeration Association is again organizing the British Refrigeration Centre on which appear "Coldrator," Frigidaire, G.E.C., Kelvinator and Prestcold domestic refrigerators. The smallest model on view has a capacity of 1½ cu ft and is of the absorption type. It is made by International Refrigerator Co., Ltd., which also shows its "Coldrator C.T.33" 3·3 cu ft compressor type machine with a new wire mesh condenser; the "C.S.70" 7·1 cu ft model with the "Buttador" compartment; and two new service cabinets with capacities of 12·1 cu ft and 17·4 cu ft respectively (illustrated).

In addition to the "DE.31" 3 cu ft refrigerator and the "DE.51" 5 cu ft model (illustrated) the General Electric Co., Ltd., introduces the new "DE.81" 8 cu ft model which incorporates such refinements as a plain bowed door with storage racks, a full-width stainless steel freezer holding up to 40 lb of frozen food, two ice trays each holding 1½ lb of ice and a quick-chiller drawer several degrees colder than the main food compartment. The main food compartment has two translucent butter dishes and saladors.





Left: G.E.C. "DE.51" 5 cu ft refrigerator. Centre: International Refrigerator "Coldrator DS.180" service cabinet. Below: Frigidaire "TOR-42" refrigerator

A noticeable feature is the increasing use of colour. In addition to white, all Frigidaire refrigerators (illus. p. 1081) are now available in red, blue, green, yellow and cream. Alternative finishes are also now available for the three Prestcold domestic models which are accompanied by service cabinets and " Prestofreeze Junior " 4·05 cu ft home freezer (illustrated). The Kelvinator exhibit includes three variants of its 7 cu ft model (illustrated), one of them embodying the exclusive " Magic Cycle " automatic defrosting device. For the small family there is a new 3 cu ft table top model, a 4 cu ft table top model being also available with a hinged shelf for storing extra tall bottles.

Features of the English Electric " EA.83 " refrigerator are the across-the-top freezer, low temperature " Coldrawer " and three door shelves. The " EA.34 " table top model is shown with right and left hand hinging and in both white and cream enamel finish. A special display model partly made of " Perspex " enables the new controlled temperature butter niche to be seen inside the door of the Hotpoint " H.30 " 4½ cu ft refrigerator (illustrated). The new Electrolux L.500 5 cu ft domestic refrigerator (illustrated) accompanies the L.H.150 3 cu ft model which has a table top and a built-in drawer.

In the commercial range, in addition to 13, 16, 25 and 40 cu ft refrigerators, Marco exhibits include the new " Minx " 4 cu ft cabinet (illustrated) for storing ice cream and frozen foods, half vision and full vision display counters and a sectional coldroom.

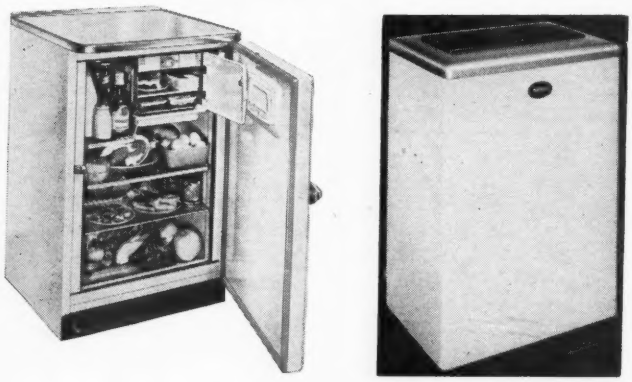
The Lighting Service Bureau is presenting demonstrations of a kind which might well be adopted by service centres and electrical showrooms as an aid to the development of the lighting load. The suitability of the recently introduced " De Luxe Warm White " fluorescent lamp for use in domestic interiors is illustrated both in terms of its colour appearance and colour-rendering properties.

Illuminated colour photographs showing fluorescent lighting at Rye House power station are a feature of the Thorn stand, where visitors can carry out colour comparison experiments with the range of " Atlas " double-life fluorescent tubes and tungsten filament lighting. A number of " Atlas " fittings in functional use are worthy of note; the " Pin-up " fitting (illustrated) for local lighting in the home, hotels and restaurants; and one of the new " Troffer " units. Ekco-Ensign have now a range of over 160 fittings to meet the majority of fluorescent lighting requirements. Of particular interest is a new luminous cornice fitting (illustrated) accommodating one 80 W 5ft lamp and incorporating reeded " Perspex " panels and metal louvres in a variety of colours. Another single 5ft lamp fitting has been designed with a definite functional approach for all forms of general purpose lighting, particularly for schools. The Ekco White (3,500 deg K) 50 W fluorescent lamp is also prominently displayed.

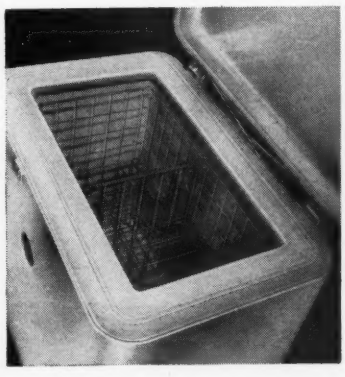
With the slogan " Almost every important lighting development in the last fifty years owes something to B.T.H." the British Thomson-Houston Co., Ltd., has photographic displays dealing with recent developments in the lamp and lighting field, including the " Mazda FA.5 " xenon flash tube and the " New Warm White " and the " De Luxe Warm White " fluorescent lamps. The " New Warm White " and " De Luxe Warm White " fluorescent lamps also form decorative light screens on the " Metrovick " stand, where there can also be seen two of the 8ft 125 W tubular fluorescent lamp fittings with the latest turret type lampholder for easy re-lamping. Crompton's mercury discharge lamps include the new fluorescent mercury type with the same bulb dimensions as the ordinary mercury type of equal rating. " Buzz-away " lamps provide a primrose yellow light that does not attract flying insects. Colourglazed lamps shown by a number of manufacturers have an external glass finish in red, white, blue, yellow, green and orange, and are highly resistant to atmospheric conditions and sea spray.

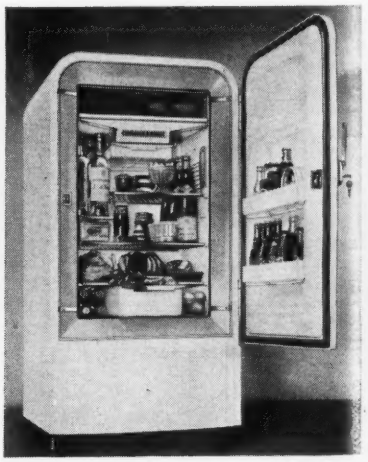
In five new " Ediswan " 5ft decorative fluorescent fittings a basic standard, one or two lamp, " power pack " channel houses the control gear and may be used with a variety of diffusers or reflectors to provide a complete range of fluorescent fittings. Street lighting lanterns incorporating fluorescent lamps are also represented.

The main features of the new Siemens " Cheltenham " lantern for Class " B " street lighting include ease of maintenance, accurate light control, a pleasing daylight appearance, and a totally enclosed construction. It houses two fluorescent

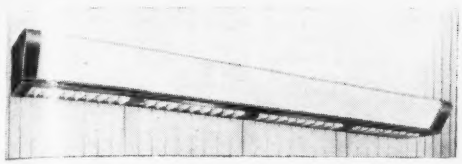


Hotpoint " H.30 " refrigerator with " Buttador " feature and (right) Marco " Minx " storage cabinet for ice cream and frozen foods

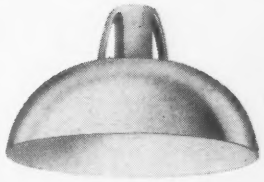




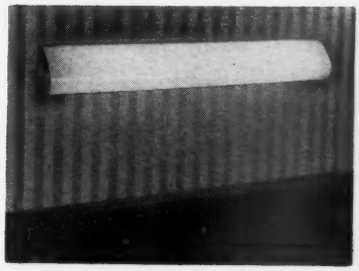
Left: Kelvinator " NSC-7E " refrigerator. Above: Prestcold " Prestofreeze Junior " home freezer. Right: Electrolux " L.500 " refrigerator



Ekco luminous cornice fitting and (right) Benjamin white plastic " Coolicon " shade



Right: Atlas pin-up lighting fitting



lamps and is entirely " cast." The Siemens flame-proof fluorescent fitting, recently approved by the Ministry of Fuel and Power, houses a 4ft 40 W tube and is particularly suitable as an inspection pit fitting or for the illumination of mines. Two of the latest Falk Stadelmann fluorescent fittings are displayed: the " Cherwell 2580 " well suited for large installations and the " Westlyn 2580 " a 5ft twin lamp fitting for larger stores and shops.

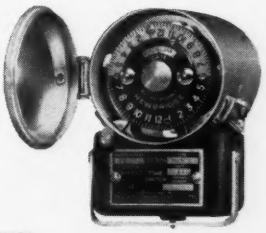
A complete range of " Coolicon " plastic shades developed by Benjamin Electric, Ltd., includes 9in models for lamps up to 60 W, 11in models for lamps up to 100 W (illustrated) and the popular " Nursery Coolicon " with gaily decorated figures. The plastic gallery and shade snap together easily and securely employing no screws, the design allowing free radiation of the heat from the lamp.

Horstmann time switches for the automatic control of street lighting and for industrial and domestic uses cover hand and electrically wound models with spring reserve and synchronous models with or without spring reserve. Of particular interest in view of the development of fluorescent street lighting, model " Q " (illustrated) is arranged to control two circuits so that by its use full lighting may be switched on at dusk, reduced to half lighting about midnight, when full illumination is not essential, and finally switched off at dawn. The very small " Y " switch, a flasher unit for pedestrian crossing beacons, and the auto time control for ovens, fires, radio sets, etc., are other exhibits.

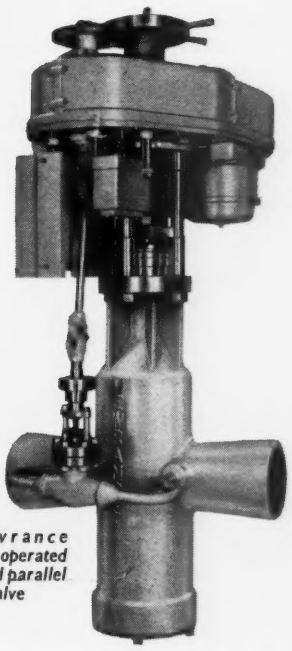
Space limitations restrict the display of generating plant but Glenfield & Kennedy, Ltd., show photographs of the equipment manufactured for hydro-electric and thermal power plants as well as actual examples of such specialized appliances as the " Glenfield " tilting disc type reflux valve and sluice valves. Among boiler mountings and valves for high pressure high temperature steam installations now being supplied by Dewrance & Co., Ltd., are an electrically operated 8in fabricated parallel slide valve (illustrated), a water gauge with a bi-colour illuminated water level indicator, and electrically operated relief valves. Although making practically every type of valve from ½in to 10in bore, A. Heaton & Co. (Valves), Ltd., are concentrating on various valves used on transformers. A new transformer radiator valve, with its stoppers sliding away completely from the base to allow the oil to circulate without any friction, costs approximately half as much as previous types of valves.

Scale models of various large Ferranti power transformers include a model of a 120,000 kVA, 275 kV transformer (illustrated) which is being supplied to the B.E.A. for the supergrid scheme, and a model of a 71,000 kVA, 301,400 V single-phase generator transformer of which four are being supplied for the Alcan Project, British Columbia, Canada. A B.E.T. 5 kVA single-phase rural type transformer has a unique new tank design which provides maximum spacing between the high-voltage terminals. The four medium-voltage terminals are fitted with locking strips of insulating materials to prevent turning of terminal stems. The transformer, which conforms to B.E.A. Specification T1, is also available in capacities of 10 and 15 kVA, 11 and 6·6 kV.

Two " Davenset " power distribution transformers displayed by Partridge, Wilson & Co., Ltd., are both designed to the current T1 Specification. The larger one, rated at 500 kVA, has its tank removed to show the internal construction. The smaller unit, a 15 kVA pole mounting type (illus. p. 1084), has an iron loss of only 72 W. Another

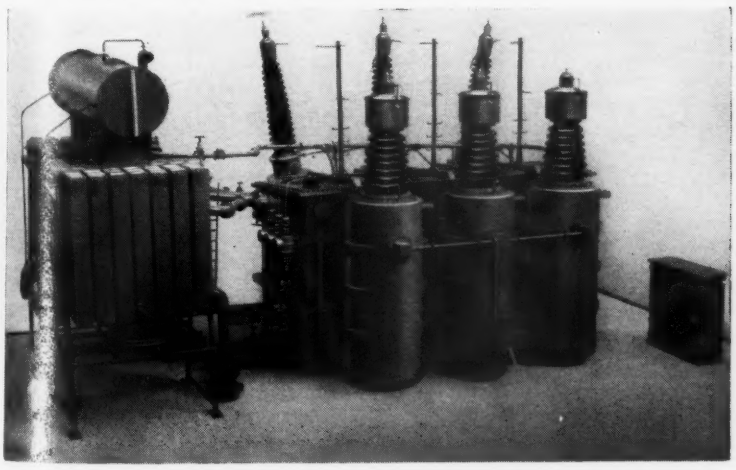


Left: Horstmann type " Q " time switch



Right: Dewrance electrically operated 8in fabricated parallel slide valve

Scale model of a Ferranti 120 MVA 275 kV three-phase ON/OFB auto-transformer with 30 per cent tapping as supplied for the supergrid system



" Davenset " product is a rectifier for charging switch tripping batteries.

A Johnson & Phillips 300 kVA, 3-phase, 50 cycle core and winding transformer is seen alongside an interesting scale model of a complete 30 MVA 132 kV transformer.

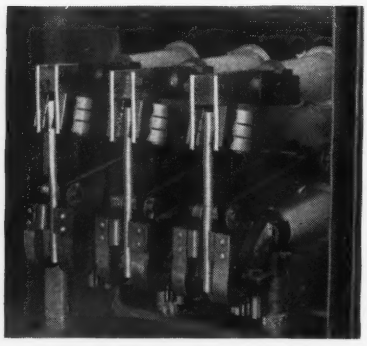
The need for providing means of maintaining a constant supply voltage is making itself increasingly felt for a wide range of electrical applications. The new Airmec 5 kVA automatic voltage regulator (illustrated) is designed so that, providing that its operating range is not exceeded, the output voltage is unaffected by variations in load, load power factor or normal changes in frequency. Automatic control is effected by two thyratron-operated relays and a special feature of the equipment is that it may be controlled by low-value external a.c. or d.c. signals instead of the normal output voltage. Accompanying this apparatus are a 5 kW electronic heat generator, a temperature controller, 5 kV and 20 kV ionization testers, and 50 kVA 6,600/440 V and 15 kVA 360–420/9,550 V transformers.

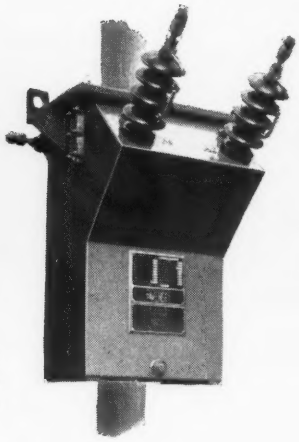
For use in transformers Monsanto Chemicals, Ltd., have produced " Pyroclor," a new fire-resistant cooling fluid. The same company's " Aroclors " used as fire-resistant capacitor impregnants permit reductions in capacitor size of as much as 35 per cent without reduction of performance, with consequent important savings in costs.

For rural application a Reyrolle ring-main unit (illustrated) has been developed with two oil-immersed switches capable of breaking their full load rating of 400 A and suitable for making circuit on to faults of up to 250 MVA at 11 kV. The complete equipment is enclosed within a single tank measuring 2ft by 2ft by 2ft 6in. The blowing of any fuse causes the automatic tripping of all three poles of the switchfuse. Another new Reyrolle product is a double-tier air-break circuit-breaker unit accommodated in one cubicle of 18in centres. Line Equipment, Ltd., who specialize in h.v. outdoor, air-break equipment show typical isolating switches up to 275 kV standard and repeater switch-fuses with h.r.c. fuse links, liquid fuses and fuse isolators and transformer excess load indicators. Fault throwing switches and certain other new equipment are in process of development.

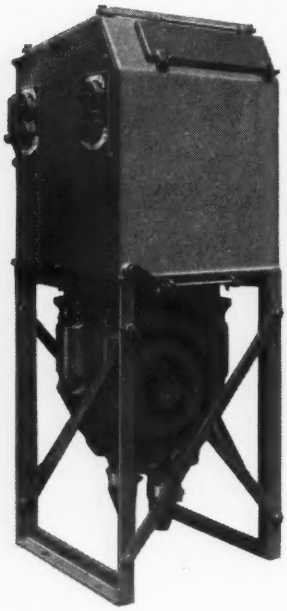
A Brush type " OR.38 " outdoor pattern oil circuit breaker with a rating of 1,000 A, 33 kV and breaking capacity of 750 MVA is fitted with a pneumo-hydraulic closing mechanism using a small quantity of oil stored at very high pressure to give four or five successive closing operations without recourse to external electrical supplies. The " VA5 " metalclad vertical draw-out indoor pattern switchgear unit (illustrated) is rated at 400 A, 11 kV with a breaking capacity of 250 MVA. It has air spaced busbars and conductors and the circuit breaker incorporates arc control devices and a manual closing mechanism with direct acting trip coils.

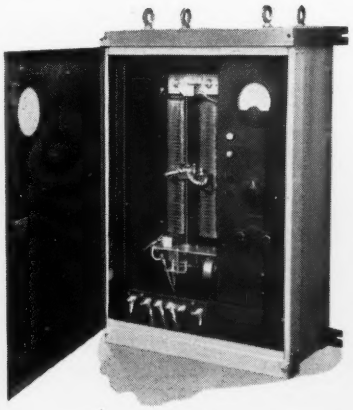
Metalclad switchgear for indoor service, shown by Crompton Parkinson, Ltd., includes a typical " ALA " metal-clad oil circuit-breaker switchgear unit coupled to an " ASA " fault-making load-breaking oil switch unit (illustrated). The " ALA " units are available in ratings up to 11 kV service voltage, 1,600 A continuous load current, and 500 MVA breaking capacity. This switchgear is of the vertically isolated class with the circuit breaker mounted on a withdrawable truck. The busbars and connections are air insulated, while the oil circuit breaker is of the arc-control, side-blast baffle-pot type. The " ASA " oil switch units are available for the following maximum values: 11 kV service voltage; 400 A continuous load current; maximum making capacity, peak asymmetrical current 55·9 kA and symmetrical current 21·9 kA.

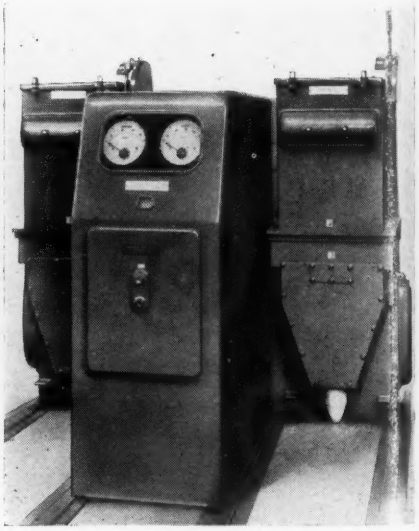




Crompton Parkinson " ASA " fault-making load-breaking oil switch in closed position, viewed from below, and (right) Partridge Wilson 15 kVA pole mounting transformer to Specification T.1







Left: Reyrolle 11 kV outdoor combined ring-main switch and tee-off fuse switch unit. Above: Airmec 5 kVA automatic voltage regulator type P.857. Right: Yorkshire " IV10 " ring-main unit for 11 kV 400 A with isolators and automatic circuit breaker fitted with new arc traps

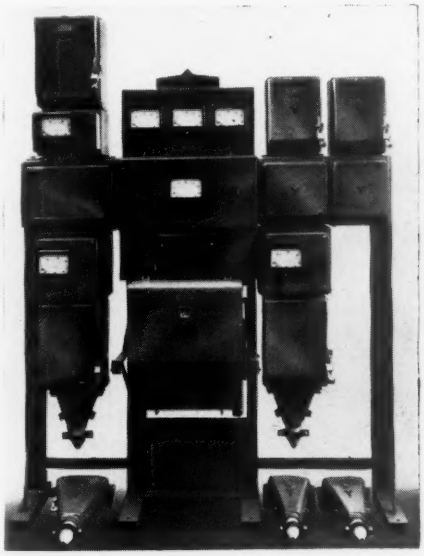
The Johnson & Phillips "AG16" air-insulated metal-clad unit is suitable for use on systems up to 250 MVA at 6·6 or 11 kV, while the "TOS" oil switch can be incorporated into any normal J. & P. h.v. switchboard; in use with a ring main unit it can be isolated for servicing purposes without interrupting the supply to adjacent units.

An automatic oil circuit breaker fitted with a new type of arc trap is incorporated in a non-extensible ring main unit for 11 kV 400 A with isolators at either side (illustrated) made by the Yorkshire Switchgear & Engineering Co., Ltd. For industrial use indoors or outdoors a fuse switchboard (illustrated) with flush mounting instruments made by the associated Electro Mechanical Manufacturing Co., Ltd., incorporates an oil circuit breaker and outgoing fuse ways.

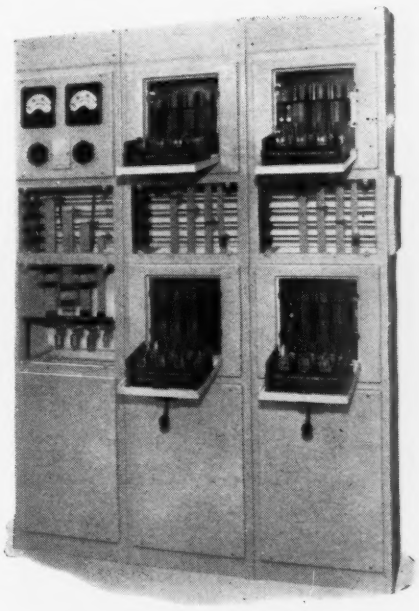
Meeting the modern demand for economy of space and "clean" lines with absence of dust traps, yet retaining the traditional advantages of easy access to all interior parts, a new 11 kV 250 MVA circuit-breaker unit (illustrated) is of special interest on the George Ellison stand where can also be seen a 45 MVA A.S.T.A. tested switchboard for voltages of up to 660 V, a new 20 A direct-on starter with h.r.c. fuses and facilities for simple isolation, a totally-enclosed rotor starter for slip-ring induction motors, a star-delta starter, limit switches and emergency push switches.

Economy in size of the building required and a reduction in maintenance costs result from a departure from orthodox design made by the South Wales Switchgear, Ltd., in its 33 kV outdoor type metalclad switchgear represented by a model of a substation forming the centre-piece of its stand. With it are a 400 250 A MVA air-insulated metalclad unit with vertical isolation, oil immersed circuit breaker and spring close mechanism; a 4·5 kVA, 11,000/250 V pole mounting power transformer conforming to B.E.A. Specification T.1; and an assortment of contacts used in oil circuit breakers.

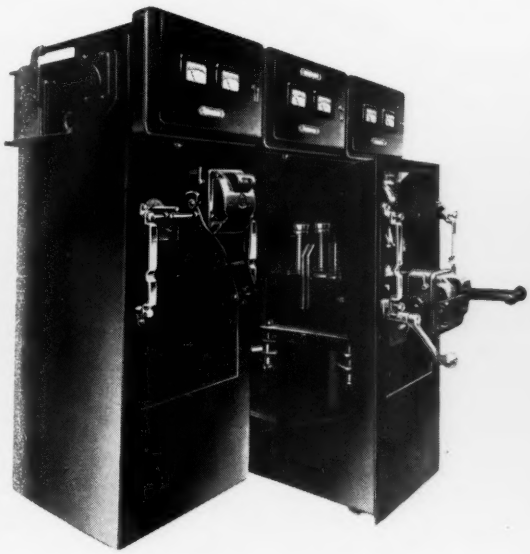
In addition to its normal range of l.v. switch and distribution gear Bill Switchgear, Ltd., introduces a new cubicle industrial panel fitted with the "Majestic" switchfuse (illustrated). These cubicles are manufactured in standard



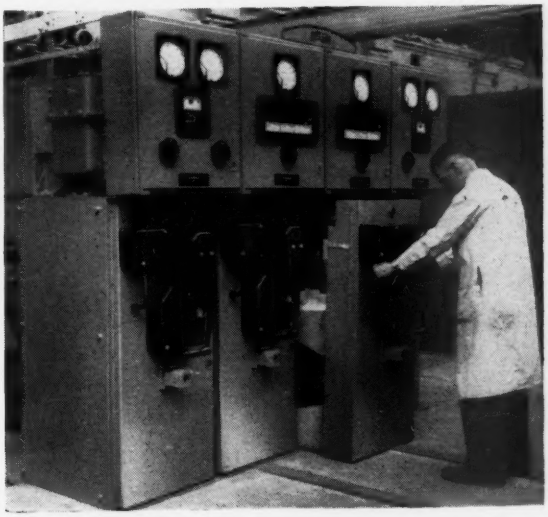
Electro Mechanical Manufacturing Co.'s indoor "Y" fuseboard



Bill cubicle fitted with "Majestic" switchfuses and (below) Brush "VA5" metalclad air-insulated vertical draw-out switchgear



George Ellison 11 kV circuit-breaker unit



widths of 22in or 26in and butt together to give a streamlined panel. The switchfuses are made in capacities of 60, 100, 160, 200 and 750 A. The " Vertex " distribution boards of 15/20, 30, 40 and 60 A capacity have been re-styled, while the range of " Crown " switchgear has been extended. A 13 A surface pattern switch socket is a new electrical accessory.

Wm. Sanders (Wednesbury), Ltd., have chosen for their display cubicle type switchboards, the " Sandaclad " fuse switches, and a range of light domestic gear. The new " Regent " switchfuse mounted on a distribution board, a selection of Lundberg " Miniac " a.c. switches and switch sockets, cooker control units and ironclad switch assemblies in all finishes (1–12 gang single pole and 1–8 gang double pole) are examples of Simplex switch and control gear. With it is a " Corrilux " bulkhead lighting fitting.

The " Metrovick " type MC six-way fuse-switch distribution board is available with maximum fuse ratings of 60, 150, 300 and 500 A respectively, in both three-pole and three-pole and neutral types, the 60 A unit being also made in a two-pole pattern. The Siemens-Schuckert type " IDS " ironclad distribution board has automatic double and triple pole circuit breakers incorporating core balance earth leakage protection (illustrated). This new device operates the circuit breaker when an earth fault of 0·5 to 0·75 A develops. It also discriminates between the sub-circuits affected by an earth fault and gives flag indication on the circuit breaker concerned. A core balance circuit breaker is effectively demonstrated by Chilton Electric Products, Ltd.

In a new range of " Diamond H " a.c. slow break single pole and double pole rotary reciprocating switches (illustrated) for domestic appliances, the whole assembly is mounted on porcelain and the switch operation is independent of the cover. The new type push-on self-indicating handle dials are fitted. A new range of thermostats, series 6TH–13TH, has provision for front of panel calibration, neon pilot lighting, automatic pre-heating and other special switching requirements.

In the new Falk Stadelmann " bracket fixing " sockets all cables and cable terminals are visible whilst the socket is fixed and before the plate is fitted, so eliminating any doubt as to the effectiveness or safety of the connections. Correct fixing is checked, the speed of installation is greatly increased and faults can be ascertained without completely dismantling the socket. There is a range of Falk Stadelmann consumer control units for surface, semi-flush, and flush fixing. Among a range of approximately 300 Clang electrical accessories is a new series of 5 and 15 A weatherproof plugs and sockets with solid brass bodies. The use of " Clangduit " flexible conduit tubing is claimed to reduce labour costs by as much as 50 per cent.

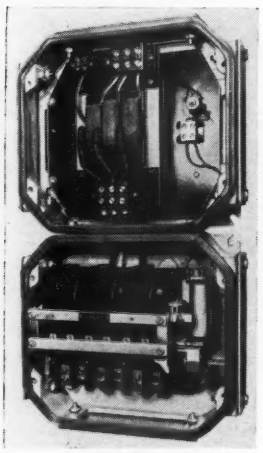
The " Avon " a.c. switch, a new all-white 5 A ceiling switch, and an architectural lampholder with a special locking device, are among " Ediswan " exhibits, which also comprise batteries for switch tripping and closing, emergency lighting, etc.

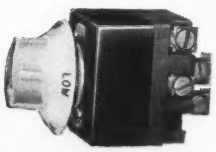
The Cable Makers' Association is using transparencies illustrating industry, transport, building and telecommunications as settings for a display of telescoped cable samples. The simplicity of operation of a typical 132 kV oil-filled cable system and the ease with which it can be accommodated to bulk power transfer requirements are demonstrated in diagrammatic and model form by Standard Telephones & Cables, Ltd. A 33 kV 3-core styrene barrier type joint is believed to be the smallest made. Four remote control and indication diagram panels show the several techniques employed in " Standard " systems.

A range of super-tension cables, aluminium sheathed cables and fully impregnated non-draining type cables, which form the central feature of the Henley stand, includes samples of oil-filled and gas cushion cables for voltages up to 132 kV, an item of particular interest being a sample of a 110 kV 3-core oil-filled cable. Among Henley distribution equipment are various units suitable for incorporating in distribution panels or pillars, also a 4-way underground disconnecting box (illustrated) which provides three cable ways at one end of the box and one cable way at the other. Power cables displayed on the Siemens stand include a range from 660 V to 33 kV, a new p.v.c. entirely insulated cable and special anti-corrosion cables. With them are switchgear, dividing boxes, tee disconnecting boxes, new types of consumers' service units, earth leakage protection devices, and telephone apparatus. The new Siemens " Sierack " system of steel racking (illustrated) which can be used for cable supports, conduit fixings, pipes, etc., eliminates costly design for individual site requirements, and simplifies erection.

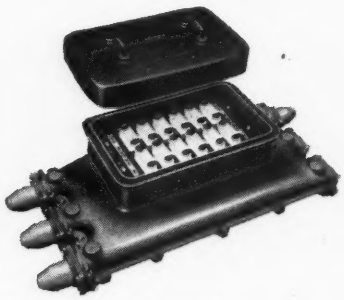
A new type of 11 kV polythene insulated self-supporting aerial cable with appropriate fittings has been designed by the Telegraph Construction & Maintenance Co., Ltd., for use in rural areas. Also of particular interest is an 11 kV polythene insulated power cable as installed at the new Queen Elizabeth II dock at Eastham. Among other Telcon products are paper insulated power cables for voltages up to 22 kV with copper or aluminium conductors and lead or aluminium sheaths, plastic insulated cables and a recently introduced armoured cable with p.v.c. insulation and overall sheathing. Falk Stadelmann's range of cables include the " Hitest " rubber insulated, " Hithene " polythene insulated and " Corrusteel " armoured types. Aluminium sheathed power and wiring cables are among a wide range of Johnson & Phillips products.

Below: Siemens-Schuckert single unit " S.12 " triple pole circuit breaker with core balance earth leakage protection



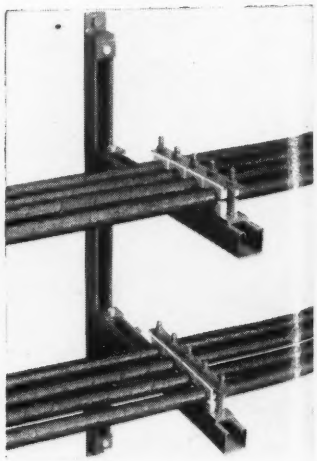


" Diamond H " a.c. rotary switch



Henley 4-way underground disconnecting box

Below: Siemens " Sierack " steel racking



An 11 kV cable joint of the fully-shielded type for screened cables has been developed by British Insulated Callender's Cables, Ltd., in view of the tendency towards greater economy in protective gear by providing protective apparatus for phase-to-earth faults only. Economy is also the aim of a simplified joint for 33 kV impregnated pressure cable installations. Among other new B.I.C.C. products in the lower voltage field are recently designed consumer's service units (illustrated), a neat terminal box for telephone and pilot cables, and moulded sealing sleeves for the termination of mass-impregnated non-draining and similar cables where sealing boxes are not necessary.

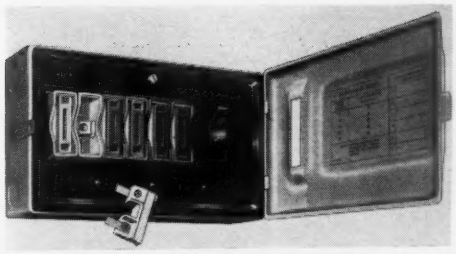
The complete range of meters shown by Smith Meters, Ltd., includes the " APR " prepayment meter, the " AM " maximum continuous rating meter and polyphase meters with or without maximum demand indicators. Photographs of the company's works indicate the equipment needed for the manufacture of house service meters. The " S.29 " watthour meters (illustrated) recently developed by Sangamo Weston, Ltd., are seen in both single and polyphase forms, the latter both as two element and three element models. They are accompanied by a representative range of Sangamo synchronous time switches and Weston electrical measuring instruments, including rectangular and round panel instruments, portable instruments, laboratory standard and sub-standard instruments, Weston standard cells and " photronic " cells and the " Master II " exposure meter.

The Metrovick " A2 " and " A3 " portable chart-recording meters, for single-phase or polyphase circuits, meet the demand for a kWh or kVAh meter for such purposes as the detailed investigation of the load in a factory or other installations. A card registering single-phase kWh meter facilitates the electricity supply authority's accounting system, while a rent or fixed charge collector (illustrated) connected in series with a watthour meter, collect periodic payments as they become due on hired apparatus, or other fixed charges. A 40 A m.c.r. capacity model of the " NF5 " single-phase kWh meter is fitted with six-figure roller cyclometer clock. The " Transva " kVA meter is now available with an alarm device.

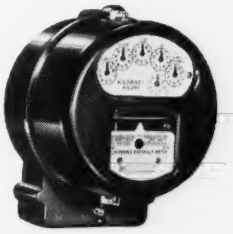
A notable Salford exhibit is a magnetic transducer system which provides a means of measuring mechanical quantities on a remotely positioned electrical indicator. Another new Salford item is the Butt type line contact circuit breaker, which employs unit construction and makes a much more compact assembly. The new Hollerith electronic multiplier shown by the British Tabulating Machine Co., Ltd., consists of a specially adapted standard gang punch and an electronic multiplying machine. As the cards are fed into the gang punch these recordings are sensed by the input unit and transmitted by electrical impulses to the electronic multiplier. This machine transmits the product back to the punch unit on the output side of the gang punch. About 6,000 cards per hour can be dealt with.

Henry Wiggin & Co.'s " Brightray " series of nickel-chromium alloys now provides a range of materials for operation at temperatures up to 1,150 deg C. " Ferry," a nickel-copper alloy, is suitable for electrical control gear and instruments where the temperature of the resistance does not exceed 300 deg C, a special grade being available for thermocouple elements. Wrought commercially pure nickel and special manganese-nickel alloys are used for electrodes and other parts of valves for radio and television, in transmitting valves and in the special types of valves developed for radar. " Kanthal Super," a new metallic electrical resistance alloy capable of operating at the very high temperature of 1,700 deg C, is introduced by Hall & Pickles, Ltd. " Nicralloy " and other " Kanthal " alloys are capable of operating at temperatures up to 1,150 deg C and 1,350 deg C respectively.

A comprehensive range of Langley London electrical insulating materials comprises mica in all its forms, tooled and fabricated work, laminated plastic sheet and tube. Silicone bonded glass fabric tubing, features of which are its high temperature resisting and low moisture absorption properties, is now being produced in quantity.

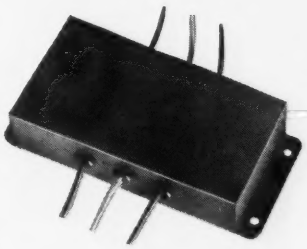


B.I.C.C. consumer's service unit



Sangamo Weston " S.29 " Form 3 meter

Metrovick fixed charge collector meter



Left: Wego radio and television interference suppressor comprising four chokes and three capacitors

Representative of Brush standard dimension motors from 1 to 25 h.p. is a 1 h.p. 1,500 r.p.m. three-phase 380/420 V squirrel cage, totally enclosed fan cooled unit. Hoover fractional h.p. motors cover a wide field of applications, including refrigerators, washing machines, machine tools, pumps, compressors, air conditioning plant, office equipment, dairy and agricultural machinery.

To illustrate reductions effected in the electricity consumption of a motor when various amounts of capacitance are switched into parallel with it, the Wego Condenser Co., Ltd., has prepared a working model. With it are capacitors for neon and fluorescent lighting, interference suppression (illustrated), impulse testing and X-ray circuits, also special units for such purposes as delay lines, pulse forming networks, general electrical research and for use as replacements in American-built equipment.

To ensure high repeat accuracy an electronic timer has been incorporated in the Siemens-Schuckert type WPO5 miniature spot welder which has been specially designed for the fabricating of small gauge material. The same company's type WP1 bench type pedal operated spot welder, which also has electronic timing, has a rating of 4 kVA and is available with either 6in or 9in arms. The Lincoln Electric Co.'s exhibit includes two new electrodes shown for the first time in this country: the " Multiweld O.V." and the " Multiweld L.H."

Metal protection is a problem which is arousing an increasing amount of attention. Sample films of " Ferrodor " paint showing the general appearance of the material and the flexibility of the coatings have been prepared by Griffiths Bros. & Co. (London), Ltd., who also exhibit insulating varnishes, various electrical parts indicating typical impregnating and finishing treatments. " Vitros " stoving finishes for water heaters, meters and domestic appliances are new additions to the company's products. Jenson & Nicholson's industrial finishes include their

solventless impregnating varnish and " One Coat " hammer finish.

The British Electricity Authority's display illustrates the increasing demand for electricity over the past thirty-four years as well as showing the construction of the load between industrial, domestic, commercial and other classes of consumers. A comparison of generation costs and electricity prices in 1920 and to-day is also given. The South Eastern Electricity Board's stand is designed to give a bird's-eye view of typical features of the Board's area and activities.

Copies of the " E.I.B.A. Year Book " and other information are available from the stand of the Electrical Industries Benevolent Association, which provides a progressive social service for all non-manual people employed in any branch of the electrical industries and now has forty-four area branches.

A 20 cwt Morrison-Electricar chassis of completely new design is the principal exhibit of Austin Crompton Parkinson Electric Vehicles, Ltd. Tomlinson (Electric Vehicles), Ltd., are showing their pedestrian controlled truck specially adapted for use as a jointers' repair and service layers' truck.

If, as we hope, the weather is warm at Eastbourne next week delegates will be glad to learn that for the ventilation of the exhibition hall forty-two of the recently introduced Revo " Ariel " ceiling fans have been installed.

The " Duo-Therm " domestic heat pump can be seen at the West Rock Hotel, Eastbourne, where Brentford Transformers, Ltd., and their subsidiary, Brentford Electric, Ltd., have arranged a private exhibition. Besides acting as a larder cooler for hygienic food storage, this equipment at the same time provides a constant supply of hot water for kitchen and bathroom. It is thermostatically controlled and has a loading of a few hundred watts only. A 12 kVA 440 V three-phase, air cooled voltage regulator, a 5 kVA automatic tail end booster for rural distribution networks, and an 11 kV/250 V pole mounting distribution transformer are also shown.

List of Exhibitors at the Eastbourne Exhibition

	Stand No.
Aidas Electric, Ltd., Sadia Works, Rowdell Road, Northolt	73
Airmec, Ltd., High Wycombe, Bucks.	29
Backer Electric Co., Ltd., Fitzwilliam Road, Rotherham	77
Baldwin, H. J., & Co., Ltd., 132, Arkwright Street, Nottingham	58
Belling & Co., Ltd., Bridge Works, Southbury Road, Enfield	65
Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17	26
Berry's Electric, Ltd., Newman Street, London, W.1	6
Best Products, Ltd., Felix Works, Felixstowe	53
Bill Switchgear, Ltd., Aston Lane, Perry Barr, Birmingham, 20	18 & 19
Blakeborough, J., & Sons, Ltd., Brighouse, Yorks.	2
Bray, Geo., & Co., Ltd., Leicester Place, Blackman Lane, Leeds, 2	33
British Electricity Authority, Winsley Street, London, W.1	99
British Insulated Callender's Cables, Ltd., Prescot, Lancs	27
British National Electrics, Ltd., Charlton, London, S.E.7	25
British Refrigeration Association, 1, Lincoln's Inn Fields, London, W.C.2	98
British Tabulating Machine Co., Ltd., Icknield Way, Letchworth	70
British Thomson-Houston Co., Ltd., 18, Bedford Square, London, W.C.1	38
British Vacuum Cleaner & Engineering Co., Ltd., Leatherhead	47
Brush Electrical Engineering Co., Ltd., Loughborough	4 & 9
Bulpitt & Sons, Ltd., Swansea Works, Birmingham, 1	62
Burco, Ltd., Rose Grove, Burnley	28
Cable Makers' Association, High Holborn House, 52–54, High Holborn, London, W.C.1	96
Chilton Electric Products, Ltd., Hungerford, Berks	56
Clang, Ltd., Crown Yard, Cricklewood, London, N.W.2	64
Cole, E. K., Ltd., Ekco Works, Southend-on-Sea	85
Crompton Parkinson, Ltd., Guiseley, nr. Leeds	7
Dewrance & Co., Ltd., Great Dover Street, London, S.E.1	3
" Diamond H " Switches, Ltd., Gunnersbury Avenue, London, W.4	14
Dimplex, Ltd., Totton, Southampton	54
Dowsing Co. (Electrical Manufacturers), Ltd., Kangley Bridge Road, Lower Sydenham, S.E.26	40
Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2	93
Ekco-Ensign Electric, Ltd., Preston House, Essex Street, London, W.C.2	84
Electric Lamp Manufacturers' Association, Lighting Service Bureau, 2, Savoy Hill, London, W.C.2	97
Electrical Association for Women, 35, Grosvenor Place, London, S.W.1	90
Electrical Industries Benevolent Association, 32, Old Burlington Street, London, W.1	5
Electro Mechanical Manufacturing Co., Ltd., Scarborough	71
Electrolux, Ltd., 153–155, Regent Street, London, W.1	79
Ellison, Geo., Ltd., Perry Barr, Birmingham, 22b	36
E.M.I. Sales & Service, Ltd., Hayes, Middlesex	13
English Electric Co., Ltd., Marconi House, 336–337, Strand, London, W.C.2	75
Falco Electrical Appliances, Ltd., Corporation Road, Audenshaw	87
Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1	22
Ferranti, Ltd., Hollinwood, Lancs	74
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2	86
Glenfield & Kennedy, Ltd., Kilmarnock	20
Graham, Alfred, & Co., Ltd., Caxton House, Westminster, S.W.1	10
Griffiths Bros. & Co. (London), Ltd., Macks Road, Bermondsey, London, S.E.16	68
Hague & McKenzie, Ltd., Pyramid Works, Sloane Street, Birmingham	80
Hall & Pickles, Ltd., Manchester, 1	83
Heaton, A., & Co., Ltd., Woodside Valves Works, Haley Hill, Halifax	41
Heatrae, Ltd., Norwich	59
Henley's, W. T., Telegraph Works Co., Ltd., 95, Aldwych, London, W.C.2	8
Hoover, Ltd., Perivale, Greenford, Middlesex	91
Horstmann Gear Co., Ltd., Newbridge Works, Bath	82
Hotpoint Electric Appliance Co., Ltd., Fletton, Peterborough	35
Hurseal, Ltd., 229, Regent Street, London, W.1	94
Jackson Electric Stove Co., Ltd., 143, Sloane Street, London, S.W.1	92
Jenson & Nicholson, Ltd., Jenson House, Stratford, E.15	89
Johnson & Phillips, Ltd., Charlton, London, S.E.7	24
Langley London, Ltd., Kelvin Way, Crawley, Sussex	55
Lincoln Electric Co., Ltd., Broadwater Road, Welwyn Garden City, Herts	16
Line Equipment, Ltd., 32, Queen Victoria Street, London, E.C.4	17
Maclaren, Robert, & Co., Ltd., 110, Kilbirnie Street, Glasgow, C.5	76
Marco Refrigerators, Ltd., Manor Works, Streatham Vale, London, S.W.16	67
Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17	61
Monsanto Chemicals, Ltd., 8, Waterloo Place, London, S.W.1	15
Newman, Hender & Co., Ltd., Woodchester, Stroud, Gloucester	57
Parnall (Yate), Ltd, North Circular Road, London, N.W.10	66
Partridge, Wilson & Co., Ltd., Davenset Electrical Works, Evington Valley Road, Leicester	1
Panelec (Great Britain), Ltd., Prescot.	63
Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2	34
Premier Electric Heaters, Ltd., Keeley Street, Birmingham, 9	37
Revo Electric Co., Ltd., Tipton, Staffs	49
Reyrolle, A., & Co., Ltd, Hebburn, Co. Durham	72
Rheostatic Co., Ltd., Slough	23
Salford Electrical Instruments, Ltd., Peel Works, Silk Street, Salford, 3	88
Sanders, Wm., & Co. (Wednesbury), Ltd., Falcon Electrical Works, Wednesbury	31
Sangamo Weston, Ltd., St. George's Court, 22–26, New Oxford Street, London, W.C.1	39
Santon, Ltd., East Acton Arcade, Old Oak Common Lane, London, W.3	44
Siemens Bros. & Co., Ltd., Woolwich, London, S.E.18	12
Siemens Electric Lamps & Supplies, Ltd., 38–39, Upper Thames Street, London, E.C.4	11
Siemens-Schuckert (Great Britain), Ltd., Great West Road, Brentford	52
Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham	46
Smiths English Clocks, Ltd., Sectric House, Waterloo Road, London, N.W.2	42
Smith Meters, Ltd., Rowan Road, Streatham Vale, S.W.16	81
South Eastern Electricity Board, Westlords, Willingdon Road, Eastbourne	100
South Wales Switchgear, Ltd., Blackwood, Mon.	32
Standard Telephones & Cables, Ltd., 10, Essex Street, Strand, London, W.C.2	60
Sunvic Controls, Ltd., 10, Essex Street, Strand, London, W.C.2	78
Telegraph Construction & Maintenance Co., Ltd., Telcon Works, Greenwich, London, S.E.10	69
Thorn Electrical Industries, Ltd., 105–109, Judd Street, London W.C.1	51
Tricity Cookers, Ltd., 109, Kingsway, London, W.C.2	50
Vactric, Ltd., 196–199, Sloane Street, London, S.W.1	43
Walter, J. & H., Ltd., 31a, Farm Lane, Fulham, London, S.W.6	95
Wego Condenser Co., Ltd., Bideford Avenue, Perivale, Middlesex	21
Wiggin, Henry, & Co., Ltd., Thames House, Millbank, London, S.W.1	48
Wilkins & Mitchell, Ltd., Darlaston, Staffs	4
Yorkshire Switchgear & Engineering Co., Ltd., 133–135, Grand Buildings, Trafalgar Square, London, W.C.2	71

VIEWS on the NEWS

By REFLECTOR

I FEEL that mention should be made of the methods of presentation of the two papers read at the Harrogate conference of the Electrical Contractors' Association. Both speakers performed their task with consummate ability, albeit in totally different ways. Mr. J. R. Halliwell adopted an urbane manner, which is not to say that he was sententious. Quite the reverse; he put over the main points in his thought-provoking paper in a forceful economical way. Mr. C. J. Veness in presenting his and Mr. Olson's paper was in contrast to this. He was delightfully informal and interjected some much appreciated asides. On both occasions one could sense that the audience was stimulated and alert, and it would be a good thing if all authors of papers adopted one of these very-different styles.

* * *

In the discussion on the paper by Messrs. Veness and Olson a standard fluorescent lamp was called for by Mr. J. Mortimer Hawkins. From the nature of the discussion it was evident that what he wanted was standardization of colour. In such a matter it can truly be said that one man's meat is another man's poison, especially as in recent experiments the effect of fluorescent lighting upon the appearance of various comestibles has been in question. What standard is to be aimed at? The "daylight" fluorescent is generally thought to be too harsh; some like the new "de luxe warm-white" and others prefer the "mellow." As was pointed out in the discussion, the earlier flight from the tungsten-filament lamp has now been regretted by some who call for a nearer approach to tungsten in the colour rendering of fluorescents. What are the poor lamp makers to do?

* * *

It seems to me that recovery from the last war is taking considerably longer than it did after 1918. This is understandable in the physical sense for the destruction during the six years was far greater than that experienced in the first war. Possibly it is this which has retarded mental and moral recovery; it is certainly true that the war mentality persists, as Mr. T. W. Heather maintained during the discussion on Mr. Halliwell's paper. Although most of the wartime restrictions have now been removed we seem to be unprepared for our freedom and still look for Government guidance (or permission) before taking necessary action. Many opportunities are arising but many of them are unrecognized or unheeded by us although some of our trade rivals are quick enough to seize them. For one thing, as Mr. Heather suggested, research is bringing forth many new and valuable ideas but they are not being developed rapidly enough. And it is in the realm of ideas that we must look for success against our competitors for world trade.

* * *

In my 28th May notes I touched upon the question of electricity tariffs for churches and quoted a "spokesman" of the North Western Electricity Board as saying that for this purpose churches must be regarded as commercial concerns. I did not see a reply to this by Mr. A. O. Johnson, chief commercial officer of the Board, which appeared in the same paper a week later. In this Mr. Johnson said that the Board had already introduced standard domestic and industrial tariffs and was dealing with charges for commercial and other premises such as hospitals, schools and churches. He further stated that churches with heating used exclusively outside peak periods could definitely be offered lower tariffs.

* * *

Last week the British Iris Society held its annual exhibition and once again a substantial proportion of the prizes were taken by two men connected with the electrical industry. From the report of the event in *The Times* I see that Mr. H. J. Randall, chairman of the London Electricity Board, was awarded one plate, two bowls and an unspecified prize, while Mr. H. Senior Fothergill, secretary of the Electrical Industries Benevolent Association, went one better with five successes. I am sorry to have missed the show which, *The Times* says, presented an extraordinary wealth of colours, including orchid-pink, rich golds, mahogany to pale brown, and the new salmon-pink shades with tangerine-orange beards.

* * *

An amusing account appeared in the *Electrical Review* of 15th June, 1874 (eighty years ago), of the electrical apparatus installed at the home of Robert Houdin as described by him in a French paper. Houdin appears to have had an amazing collection of devices. One door to the house bore a plate with the owner's name on it. When the knocker was operated by a visitor a "peal of bells" sounded throughout the house, an electric lock was operated from inside the house, and the nameplate was replaced by another marked "Entrez." There was an ingenious system by which the nature of the morning post was communicated to the owner while he was still in bed. The stable door was electrically locked and unlocked and there was an electrical arrangement for tipping the right quantity of oats into the manger. There was also what appears to have been a forerunner of the master clock and "slave" dial timekeeping system, as well as some form of distant thermometry. Houdin (1805–71) was a French conjuror who (as might have been expected from the foregoing) made extensive use of electro-magnetic devices in his performances.

* * *

A resident of Berkswich, Stafford, is reported by the *Daily Herald* to have expressed his horror of street lighting in the village in downright terms. He says that "the urbanizing of small villages is a festering sore in the countryside." Lighting was not the bottom of the decline, however; he said that once they had lighting they would next want bus shelters.

Control Exciter Systems

An Explanation of the Basic Principles

IN many manufacturing processes the rate of production and the quality of the finished product depend upon the accuracy with which the various drives can be controlled, and the demand of industry to-day is for control systems which will provide a speedy response combined with a high degree of sensitivity and freedom from instability. The closed loop control system embodying a control exciter has proved particularly suitable for these requirements and many such equipments have been supplied and installed by the General Electric Co., Ltd.

A closed loop system of control is one in which the regulating device, in this case the control exciter, has a measured quantity (voltage, speed, current, etc.) fed back into it, and the system tries to keep this measured quantity to a predetermined datum. The design problems involved in such a system are outside the scope of this article, but an understanding of the principles is of importance to a growing number of users.

From the user's point of view, the control exciter is basically a normal d.c. generator with the usual armature windings, brush gear, commutating pole windings, etc., and is equally simple to maintain. It must of course be carefully designed for transient performance.

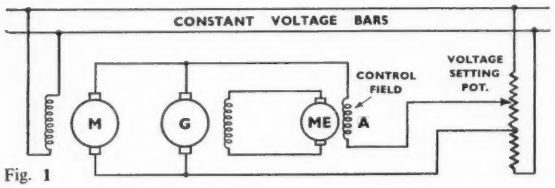


Fig. 1

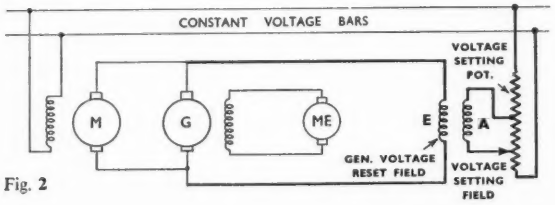


Fig. 2

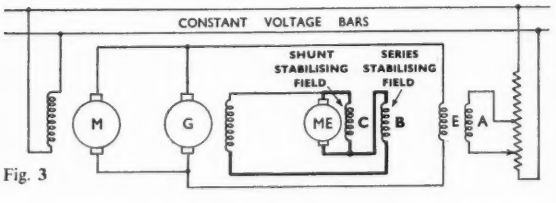


Fig. 3

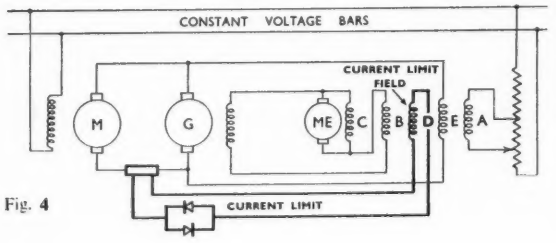


Fig. 4

The most obvious difference between the standard d.c. generator and control exciter is that whereas the former has laminated main poles with a solid steel magnet yoke, the control exciter has its complete magnetic circuit laminated, including the magnet yoke. It is also provided on the main poles with a number of field or control coils depending on the particular control function to be carried out. If the magnetic yoke were the usual solid steel type, eddy currents would be induced in it by the rapidly changing magnetic flux, and this would initially prevent the magnetic flux from following the resultant applied ampere turns of the control coils. Therefore, the whole magnetic circuit must be constructed from steel laminations.

Main Requirements

The requirements of any closed loop control system are summarized below and are fully met by such systems which embody a control exciter: (1) Simplicity both from the point of view of operation and maintenance. (2) Extremely rapid response. As an example, the reversal time for a 5,000 h.p. 50 r.p.m. rolling mill motor with this form of control is of the order of 1½ sec. (3) High degree of sensitivity. (4) Accuracy, speed control within plus or minus ½ per cent being attainable. (5) Ease with which amplification can be increased by connecting two or more control exciters in cascade. (6) Complete freedom from instability. (7) The ease with which overriding controls can be added. (8) Adaptability to speed, voltage, current or positional control.

Although the particular functions of the control exciter may differ according to the requirements of the drive in question, the principle of operation remains the same and will be evident from the various schematic diagrams. These show the application of the control exciter to Ward-Leonard schemes, and it should be noted that in each diagram the motors driving the control exciter and the main generator have been omitted for the sake of simplicity.

The basic circuit for voltage control of a d.c. generator (G) is shown in Fig. 1. By means of a control exciter the voltage of the d.c. generator is made to conform to the pattern or reference voltage established by the setting potentiometer. To accomplish this, the armature of the control exciter (ME) supplies the field winding of the d.c. generator, and the control field (A) of the control exciter (ME) is supplied with a voltage which is the difference between the output voltage of the generator (G) and the reference voltage, as these two voltages are in opposition. A comparatively small difference is sufficient to produce the full output voltage on the main generator because of the high amplification of the control exciter.

On starting up, the full value of the reference voltage is applied across field (A) of the control exciter (ME). This gives a very high over-excitation to the control exciter as, at the moment of starting, there is no opposing voltage from the d.c. generator. This results in the control exciter supplying a high initial forcing voltage to the field of the d.c. generator so that its output voltage

builds up quickly and consequently the d.c. motor (M) accelerates up to speed rapidly. In other words, it ensures a speedy response of these two functions to any movement of the voltage setting potentiometer. As the voltage of the d.c. generator (G) builds up, it opposes that of the reference potentiometer across the control field (A) of the control exciter (ME) and reduces the value of its field current to the small value required to produce the desired d.c. voltage in the generator (G) as determined by the voltage setting potentiometer.

Any change in the output voltage of the generator (G) or in the reference voltage disturbs this state of balance and results in an immediate increase or decrease in the output of the control exciter (ME) and consequently of the generator (G) so that balanced conditions are restored rapidly and accurately.

When the master controller is moved to the "off" position, the control field voltage, which is derived from the reference potentiometer, is zero, so that this field is excited solely from the main generator (G) and a high over-excitation in the reverse direction is given to the exciter (ME). This, in turn, forces reversal of the excitation of the main generator (G), the voltage of which is quickly reduced. Therefore, the motor (M) starts to regenerate and a heavy current flows from this motor to the generator. Thus the motor (M) is brought quickly to rest under regenerative braking.

It will be noted that in Fig. 1 the main generator (G) is connected through the reference potentiometer and control field (A) to the constant voltage bars. In many installations several motors may have to be controlled and a number of control exciters may be fed from the same constant voltage bars. In such circumstances a fault could result in one of the main generators feeding into the constant voltage bars and this would affect all the control exciters and consequently the machines under control.

Therefore, as shown in Fig. 2, in practice it is usual to provide an entirely separate field (E), on the control exciter, and to excite this field from the main generator. This field opposes the control field (A) so that the principle of operation of the control exciter remains unaltered.

Stabilizing Field

To prevent hunting, series and shunt stabilizing fields (B) and (C) are provided on the control exciter (ME) as shown in Fig. 3. Normally, the series field (B) is arranged to assist and the shunt field (C) to oppose the control field (A). When the generator field is changing rapidly, the current in the shunt field (C) rises far more quickly than that in the series field (B) owing to the damping effect of the inductance of the generator field. Thus the immediate resultant of the two stabilizing fields opposes the control field, and the rate of response is damped so that overshooting, in the event of sudden changes in the reference voltage, is prevented.

Under steady running conditions the series and shunt fields (B) and (C) are nearly in balance, the series field providing just sufficient extra excitation to preserve the requisite output from the control exciter. With this arrangement, the exciter is nearly self-exciting which has the effect of increasing the accuracy of the system because only a very small input to the control field (A) will result in full output from the machine.

To safeguard the motor under control, it is necessary to provide means whereby the current flowing through the machine when accelerating up to speed or when stopping is limited to a maximum safe value. This is achieved by introducing a current limit field (D) in the control exciter (ME) as shown in Fig. 4. This field is connected in series with two metal rectifiers across either

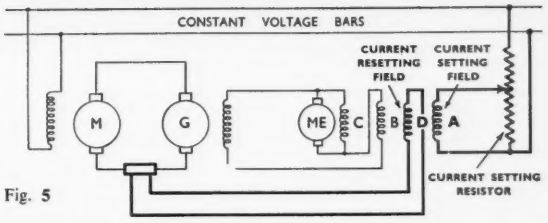


Fig. 5

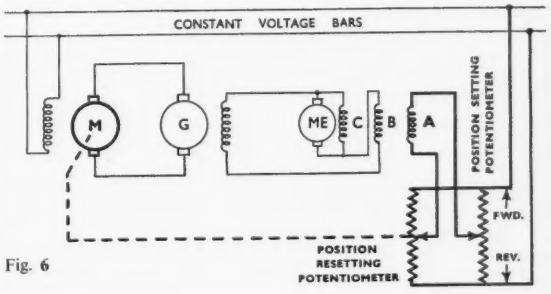


Fig. 6

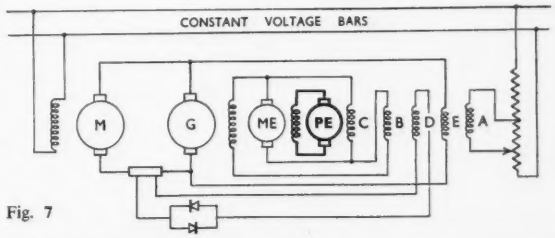


Fig. 7

a shunt in the main circuit between the motor and generator, or across the compole winding of either of these machines. It will be seen from the diagram that there are forward and reverse rectifiers to limit motor current in either direction. When the current circulating between the motor and generator exceeds a certain required limiting value, the volt drop across the shunt causes the appropriate rectifier circuit to be conducting (a metal disc rectifier requires a small but definite voltage in the forward direction before it can pass current). Thus any further increase in current circulating between motor and generator causes an appreciable current to flow in the field winding (D).

Since the field (D) opposes the control field (A), the output of the exciter and consequently the excitation of the generator (G) is reduced, thereby limiting the generated voltage to a value which ensures that only a safe maximum current will flow through the motor (M). Similarly when stopping the plant and the motor starts to regenerate, the reverse current flowing from the motor to the generator is limited by the other rectifier to the predetermined safe value. Thus, with this system of control the motor (M) is accelerated and retarded in the shortest possible time compatible with safety of the electrical machines, the control being entirely automatic.

The application of the control exciter system to current control is shown in Fig. 5 from which it will be seen that the principle of operation is the same as for voltage control, i.e., balancing a current resetting field (D) against a control of current setting field (A). The current flowing in the control field (A) is determined by the position of the current setting resistor, while that in field (D), which is connected across a shunt in the main circuit between the motor (M) and the generator, or across the compole winding of either of these machines, is dependent upon the current flowing in the circuit of the motor (M).

The circuit for positional control is shown diagram-

matically in Fig. 6 from which it will be seen that normally the voltage across the control field (A) is zero. Any movement of the position setting potentiometer produces a voltage in the selected sense across the control field (A) of the exciter (ME) which immediately energizes the generator (G) so that the motor (M) begins to rotate in the desired direction. This machine operates the position resetting potentiometer and adjusts the voltage tapping until it corresponds to that selected on the position setting potentiometer when the voltage across the control field (A) will again be zero. Hence the generator (G) is no longer excited and the motor (M) stops in the selected position where it will remain stationary until the position setting potentiometer is again moved.

Where a greater degree of amplification is required than can be obtained from a single exciter, it is a simple matter to arrange two or more control exciters in cascade. A diagrammatic arrangement of two control exciters in cascade, with current limiting feature, is shown in Fig. 7. The operation of the control system follows that explained above but in this arrangement the first control exciter or pilot exciter (PE) with multiple field A, B, C, D, and E, energizes the second or main control exciter (ME) which in turn supplies the field of the main generator (G).

Where a particularly high degree of accuracy is essential, it may be necessary to arrange for a very small signal to initiate a change in the speed of a motor. In such cases an electronic or magnetic amplifier may be used to provide the initial amplification of the signal, before it is fed to the first of two or more control exciters connected in cascade, the subsequent control circuit following the general pattern already described.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electrical Films

REFERRING to Mr. Sansom's comments on cine screen sizes in your issue of 31st May, I would like to point out that while one can find odd sizes quoted in catalogues of equipment, the best known makers generally list screen sizes which have the ratio of 4 to 3, e.g., 8ft by 6ft or 6ft by 4ft 6in, and that periodicals dealing with cine projection refer to similar sizes.

And one further point. If Mr. Sansom will cast his mind back, he will remember that not long ago the B.B.C. changed the ratio of the television screen from 5 to 4 to 4 to 3, the reason being to line up with cine practice and thus facilitate the transmission of cine films.

Broxbourne, Herts. T. L. FRANKLIN.

Engineering Qualifications

IN your remarks on the report of the Institution of Electrical Engineers there would appear to be some concern at the country's shortage of "professionally qualified electrical engineers."

While I fully appreciate the desirability of such qualifications, have we now reached a stage in this country where employers feel themselves unable to engage engineers unless they are professionally qualified?

This would indeed appear to be the case since, after 18 years of experience in the electrical contracting industry connected with urban and rural distribution schemes, I have failed repeatedly over the past six months to obtain any offers of employment.

Cannot a man with specialist knowledge be recognized unless he has attended some university or is a member of the I.E.E.? DUCAT.

Unusual Accident

I WAS recently called to an unusual fatal accident case. A woman selling food was standing at the back door of a house near to which was an earth wire leading from the house down to the ground. She touched the wire and received a fatal shock.

Upon investigation it was found that two small animals of the rodent family had entered the fuse box and one had got across phase and neutral with disastrous results, but upon further test and examination it was found that the earth wire was broken off with 6in in the ground and therefore there was no earth.

It was an unfortunate coincidence that the woman touched the wire almost at the same time that the animal was killed as no doubt soon its body would have dried up and provided no path. J. A. HILL,

Rangoon, Burma. *Government Electrical Inspector.*

"Lit-up" Transformers

WHILE I am never quite sure whether "Reflector" is to be taken seriously, I would like to assure those of your readers who are contemplating a holiday visit to the charming village of Laxey that the transformers serving the village are *not* overloaded and that they will be in no danger of anything other than sunburn.

"Reflector" places himself on the same level as the radio dealer if he infers that the normal corona discharge on a damp evening is a symptom of transformer overloading.

As for interference—well, we all have our ideas about this, and if we could have a little more signal strength "Reflector" would have no more excuse for running down our lovely Island and its small but efficient Electricity Board. L. DOUGLASS,

Douglas, I.O.M. *Engineer and Secretary,* Isle of Man Electricity Board.

["Reflector" assures Mr. Douglass that in this instance he was not to be taken seriously.—Editors, *Electrical Review*.]

Parsons Centenary

TO commemorate the centenary of the birth of Sir Charles Parsons an exhibition, arranged by the Rector and Council of King's College, Newcastle-upon-Tyne, will be held from 15th to 26th June in the Stephenson Building, Claremont Road. This event will be preceded on 14th June at 6 p.m. at the same place by a lecture (arranged by the Stephenson Engineering Society) to be delivered by Professor Aubrey Burstall on the place of Sir Charles Parsons in the history of mechanical engineering. Tickets for the lecture (number limited) are obtainable from Mr. R. W. Shield, North Eastern Electricity Board, Carliol House, Newcastle-on-Tyne.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

AS briefly reported last week **Mr. Victor C. H. Creer,** M.A., a director of the British Thomson-Houston Co., Ltd., has been elected chairman of the Council of the Electric Lamp Manufacturers' Association for 1954-55. He succeeds Mr. C. J. W. Scott, of Crompton Parkinson, Ltd. A wartime administrative officer at the Ministry of Economic Warfare and later at the Air Ministry, Mr. Creer subsequently became widely known to executives in the electric lamp industry as Deputy Director of Lamp Production at the Ministry of Aircraft Production, and the Government authority on the production of electric lamps. He joined the B.T.H. Co. in 1945 and was appointed director, lamp and lighting sales, in 1948. Mr. Creer is also a director of two companies associated with B.T.H.—Glass Bulbs, Ltd., and Lamp Caps, Ltd.

Mr. V. C. H. Creer

Mr. A. G. W. Goulding has joined Alliance Wholesale, Ltd., as manager of the Luton branch. Since 1946 Mr. Goulding has been connected with the electrical side of the oil industry, and before his war service in the Army he was departmental manager with the Sloan Electrical Co., Ltd. **Mr. H. G. Wood,** who has been at the Luton branch for several years, is being transferred to the company's Croydon branch.

Mr. M. J. Gartside, chairman and managing director of the Rheostatic Co., Ltd., left London by air on 29th May on a world trip, during which he will travel more than 30,000 miles. He will visit Canada, New Zealand, Australia and South Africa and expects to return to England during the second week in August.

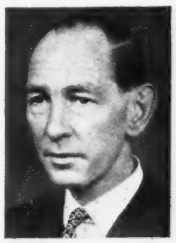
Mr. E. A. Atkins, area manager of the Cardiff Branch of Siemens Electric Lamps & Supplies, Ltd., has retired. He joined Siemens Brothers Co., Ltd., in June, 1908, and was transferred to Siemens Electric Lamps & Supplies, Ltd., in 1931. For some years he was manager of the Battery Department and in 1948 he went to Cardiff as branch manager. **Mr. W. A. Cooper** has succeeded him as area manager at Cardiff.

Mr. C. M. Johnson, area manager of Siemens Belfast Branch, retired on 31st May. He joined the Britannia Lamp & Accessories Co. in 1917, and when in 1920 this company was absorbed in the Siemens organization, he was transferred to Siemens Electric Lamps & Supplies, Ltd. **Mr. G. N. Armstrong** has been appointed area manager at Belfast in place of Mr. Johnson, whose services will still be available in an advisory capacity.

Mr. J. H. Christie, formerly of Lawson Turnbull, Ltd., electrical wholesalers, Aberdeen, took up an appointment as lamp salesman with the British Thomson-Houston Co., Ltd., at Dundee on 1st June.

Mr. M. E. O'K. Trowbridge, B.Sc., A.C.G.I., A.M.I.Chem.E., has been appointed general sales manager of Sharples Centrifuges, Ltd.

Commander C. M. Jacob, D.S.C., A.M.I.E.E., R.N. (Retd.), has been appointed deputy technical manager of the Marconi International Marine Communication Co., Ltd., and takes over his new duties immediately. Commander Jacob was educated at Osborne and Dartmouth and specialized in radio and radar work during the greater part of his naval career. After extensive service he was appointed to the Home Fleet as fleet wireless officer and fleet radar officer and in 1942 he was transferred to the Admiralty for radar work with the Director of Radio Equipment; while there he compiled the Royal Navy's Radar Operational Manual. He returned to sea duties in time to take part in the closing stages of the war in the Pacific in H.M.N.Z.S. "Gambia," attached to the British Pacific Fleet. Subsequently he served as deputy captain-superintendent of the Admiralty Signal and Radar Establishment, naval adviser to the Director of Communications Development at the Ministry of Supply, and deputy chairman of the British Joint Communications-Electronics Board.



Commander C. M. Jacob

On 29th May Brush employees and their families were joined by the general public for the open day at the works of the **Brush Electrical Engineering Co., Ltd.** Among the visitors was the new Mayor of Loughborough, Councillor L. W. Hull, who was received by Mr. J. W. C. Milligan, managing director of the company. Many shops were in operation and the public were able to see the various stages of manufacture of the company's wide range of products. There was a total of 4,000 visitors.

Mr. N. V. Baldwin, M.I.E.E., has been appointed managing director of Brookhirst Igranic S.A. (Pty.), Ltd., the South African subsidiary of the Electrical Division of the Metal Industries group of companies. Mr. Baldwin has been connected with the Igranic Electric Co., Ltd., Bedford, for more than forty years, nineteen as manager of the company's Bristol office and, latterly, as London office manager. He is a past president of the Bristol Association of Engineers and a past service member of the Bristol Rotary Club. During the war years he served with the Royal Engineers and Royal Corps of Signals, attaining the rank of lieutenant-colonel. Mr. Baldwin sails shortly to take up his appointment at the Johannesburg office of the company.

After forty-eight years with the firm of Handcock & Dykes, consulting engineers, of Westminster, **Mr. Charles William Smith,** M.I.E.E., has retired and is now living in the Isle of Wight.

Mr. Robert Stewart, managing director of Andrew Stewart & Sons, Ltd., wholesale electrical merchants, Palmerston North, New Zealand, is arriving in London late in July for a two months' visit. His object is to arrange to represent British manufacturers of domestic appliances, motors and control gear, installation materials and accessories, etc. His address will be c/o Bank of New South Wales, 47, Berkeley Square, London, W.1.

Mr. G. R. Marsh, who has been a director of Wickman, Ltd., for fourteen years, has now been appointed managing director.

Mr. G. R. Marsh

The following officers have been elected to the **I.E.E. London Students' Section Committee** for the 1954 - 55 session:— Chairman, Mr. M. C. Cubitt (Pye, Ltd.); vice-chairman, Mr. M. H. F. Collins (British Thomson-Houston Co., Ltd.); hon. secretary, Mr. K. W. E. Gravett, M.Sc.(Eng.) (Post Office Research Station, Dollis Hill).

Mr. R. H. Halls, the present district commercial engineer at Letchworth, has been appointed district commercial engineer to the new Stevenage District of the Northmet Sub-Area, Eastern Electricity Board, as from 1st June, and his office will be at 38, High Street, Stevenage. **Mr. M. G. Bidnell,** the district commercial engineer of the old Stevenage District, has been appointed electricity service manager at Letchworth and his address will be Works Road, Letchworth.

Mr. R. Bate, M.I.E.E., has been appointed sales director of Enfield Cables, Ltd. He will take up his duties on 5th July.

The South Eastern area final of the **Electrical Industries Golf Championship** will be held this year at the Royal Eastbourne Golf Club on 9th July. The area finalists will play in the morning and the winner, runner-up and best scratch score will be eligible to play in the national final. In the afternoon there will be a visitors' open competition and the proceedings will end with a dinner at the Clubhouse at which the president of the E.I.B.A., Sir John Dalton, will take the chair.

The East Midlands Area final will be held at Rushcliffe Golf Course, East Leake, Notts, on 14th July. Further information can be obtained from the hon. secretary, Mr. Peter M. Furse, Traffic Street, Nottingham.

The Essex Branch Committee of the **Electrical Industries Benevolent Association,** which has recently been reconstituted under the chairmanship of Mr. W. E. Wardrop, has decided to hold the first Essex E.I.B.A. ball at the Shire Hall, Chelmsford, on 8th October; it will include a running buffet and cabaret. Applications for reservations (price one guinea each) should be made to Mr. E. E. Cooper, hon. secretary, Essex Branch, E.I.B.A., Millfield, Bentley, near Brentwood, Essex.

Captain's day of the **Lancashire and Cheshire Radio Industries Golfing Society** was held in ideal conditions on 26th May at the Hazel Grove Golf Club and proved to be one of the most successful functions the society has held. Forty competitors entered the competition for the Captain's (Mr. Ernest Freeman) Prize, which resulted in a win for Mr. C. Sidebotham (Worsley). The 9-hole greensome competition held in the evening was won by Mr. C. Woods and Mr. E. Stonehill (Bolton).

OBITUARY

Mr. Harry Bromley, a co-director and founder with Mr. Frank Langton, of the Bromley-Langton Electric Wire & Insulator Co., Ltd., Slough, died on 16th May in a nursing home at Hove. Mr. Bromley, who was sixty-eight, met Mr. Langton soon after the 1914-18 war and in 1927 they decided to set up in business together in London, transferring the business to Slough in 1936.

Mr. C. Jago.—The death has occurred at the age of thirty-nine, after a long illness, of Mr. C. Jago, chief development engineer of Hoover (Washing Machines), Ltd., Merthyr Tydfil. Mr. Jago joined Hoover, Ltd., in 1942 as planning engineer in the production engineering department at the company's Perivale, Middlesex, factory. He was one of the original members of the company's supervisory team who went to Merthyr in 1946 to prepare for the company's new enterprise there.

Mr. Norman Burton, senior partner of Norman Burton & Brother, Manchester, which has for forty-four years represented the Micanite & Insulators Co., Ltd., in Cheshire, Lancashire and the West Riding of Yorkshire, died on 26th May.

WILLS

Mr. R. J. Plummer, chairman and managing director of Ceag, Ltd., who died on 14th February, left £110,090 gross (£105,910 net).

Mr. C. L. Sowter, chief accountant of Newton Brothers (Derby), Ltd., who died on 27th January last, left £5,692 gross (£5,652 net).

Mr. J. Rogers, late general manager of works of the English Electric Co., Ltd., who died on 15th February last, left £12,803 gross (£12,651 net).

Crystal Palace Television Mast

It is now possible to give some details of the aerial tower which the British Insulated Callender's Construction Co., Ltd., is to design and erect for the new B.B.C. London television transmitter at Crystal Palace which will eventually replace the station at Alexandra Palace. The new tower is to be a self-supporting lattice-steel structure 640ft high and will have a base width of 120ft. For the first 440ft it will taper after the manner of the Eiffel Tower and from this point until it reaches the height of 600ft will be of square construction with parallel sides of 9ft 6in square section. The top 40ft of the tower, which is also to be of square section, will have parallel sides of 2ft 6in face width.

The structure will be designed to resist wind pressures varying from 27 lb/sq ft at the base to 55 lb/sq ft at the top. Allowance has been made for icing in bad weather and the tower will resist these wind pressures even when all its members are coated with 0·5in of ice. Between the 440ft and 640ft levels eight stacks of four dipole aerials will be mounted and at 440ft provision will be made for the installation of dish-type receiving aerials for picking up outside broadcast transmissions.

The foundations of the tower are being specially designed to provide for the possibility of future underground extensions of the transmitter buildings beneath the structure. The tower itself will be provided with an electrically-operated hoist to carry two passengers or a goods load of 5 cwt to a height of 440ft. The whole structure will be of bolted construction and will weigh about 370 tons. All structural members and connections will be hot dipped galvanized at the works of Painter Bros., at Hereford, who will fabricate the steel work.

PARLIAMENTARY REPORT

In the House of Commons last week Mr. Leslie Hale asked the President of the Board of Trade how many applications had been received for the export of diesel generators to the U.S.S.R. and how many applications had been refused or deferred.

Mr. Heathcoat Amory, Minister of State, Board of Trade, said that since 1st May, 1953, eight applications had been received and four had been approved. A decision on two applications and on some of the goods covered by the remaining two had been deferred pending the completion of the review of security controls on which the Government was engaged in consultation with other Governments.

Cable-Making Prices

Mr. Palmer asked the Minister of Supply when it was expected that the cable-making associations would supply the information asked for about prices charged to the British Electricity Authority in relation to those charged to other users of electric wires and cables.

Mr. Low, the Parliamentary Secretary, said that the Government had asked the trade associations concerned to give an assurance that they would furnish the Government from time to time with information about the relationship between prices charged to the B.E.A. for mains and high voltage cable and those charged to other buyers. It was proposed to ask for this information at regular intervals. The details remained to be settled.

NEXT WEEK'S EVENTS

In addition to the British Electrical Power Convention which opens at Eastbourne on Monday next, the annual convention of the Association of Mining Electrical and Mechanical Engineers is being held from Tuesday to Friday in Glasgow. I.E.E. members are reminded of the exhibition of apparatus arranged by the Education Discussion Circle which will be held at the Engineering Laboratory of the Battersea Polytechnic on Friday at 6 p.m.

Progress of Snowy Hydro-Electric Scheme

From Our Sydney Correspondent

WITH the end of the first five years' work on Australia's biggest hydro-electric scheme it is now possible to survey the position attained. Current development is being concentrated in three main areas—Cuthega-Munyang (on Mount Kosciusko), Adaminaby and Cabramurra (near Kiandra). By far the most work has been done in the Guthega-Munyang area which, for the time being, is virtually where the scheme begins. It was there that the first major job in the whole gigantic Snowy Mountains scheme was recently completed—the Guthega-Munyang tunnel—and it is there that, later this year, the first electricity to come from the Snowy scheme will be generated. Guthega and Munyang are both construction camps only a few miles apart and not far from the Mount Kosciusko chalet.

At Guthega a dam is being built across the Snowy River. Its walls will be 110ft high and already it is about four-fifths complete. The Guthega-Munyang tunnel is 3¼ miles long, horseshoe in shape and roughly 19ft in diameter. It will carry the water from the dam, under part of Mount Kosciusko, to a point above a power station being constructed at Munyang, the descent to the station being through steel pipes half a mile long. The power house building is complete and three turbo-generators are expected to be in operation by the end of the year; the electricity they will produce will be the first "dividend" paid by the Snowy Mountains Authority on the millions of pounds which the Commonwealth Government is investing in the scheme. A Norwegian company, Selmer Engineering Pty., Ltd., drove the Guthega-Munyang tunnel and it also has the contracts for the dam and the power-house building. Although the tunnel was driven mainly through granite, it took only a year to build. This was achieved by shifts of men working 24 hours a day.

This section also involves the construction of a big dam at Adaminaby, the driving of a 14-mile tunnel through the mountains, the building of two underground power stations and, later, more tunnels, dams and power stations. The Adaminaby dam will have a capacity of 3,860,000 acre-feet and the tunnel will be driven from the side of the dam to the Tumut Pond (or dam). Even this tunnel will hold the title of the longest in Australia for only a few years, because another to be driven westwards under the mountains from Jindabyne will be 30 miles long. Work is now well under way on the building of the Adaminaby dam and American companies will soon begin driving the tunnel from Adaminaby to Tumut Pond, estimated to cost about £1,000,000 a mile. This same group of companies, the Kaiser group, will also build the Tumut Pond dam, and a tunnel to a nearby underground power station.

The job of building the Adaminaby dam has been undertaken by the N.S.W. Department of Public Works. This dam will have an earth and rock filled wall about 400ft high, 2,000ft long, and nearly half a mile wide at the base. The dam is being built across the Eucumbene River which will bring to it some of the water stored in the dam at Jindabyne, 10 or 15 miles away. For about a year bulldozers have been clearing away the porous top soil where the dam wall is to be built and a subcontractor, Allied Construction Pty., Ltd., has just completed a diversion tunnel, 30ft in diameter, to carry away the waters of the Eucumbene while the dam is being built.

From Tumut Pond the water will be fed to the underground power-house to be known as "T 1." A group of French companies has been given the contract to build this station in an excavation under one side of the Tumut Valley and is expected to begin work there later this year. By 1959 or 1960 the station should be developing 320,000 kW.

The Snowy Mountains Authority is now building a road down from the settlement of Cabramurra into the Tumut Valley to the point where the tunnel leads into the power station site.

The Victorian Government is unlikely to take any power from the Snowy hydro-electric project unless it is cheaper than power produced locally in Victoria. The Commonwealth is said to want Victoria to take at least 25 per cent of the output, but the State Government will not commit itself until it knows the cost. Ministers said that the State Electricity Commission of Victoria was producing from brown coal the cheapest electricity in Australia.

World Power Conference

AT the Brazilian Sectional Meeting of the World Power Conference to be held at Rio de Janeiro from 25th July to 10th August, the British Government is to be officially represented by Lord Citrine (chairman, British Electricity Authority). The official delegate of the British National Committee will be Sir John Hacking (Merz & McLellan), its vice-chairman. Other intending British participants are: Sir Vincent de Ferranti (chairman, International Executive Council, W.P.C.); Dr. A. Parker (hon. sec., British National Committee, W.P.C.); Messrs. C. H. Gray (sec., I.E.C. and B.N.C.); J. G. Boddy (B.T.H.); Dr. L. G. Brazier (B.I.C.C.); Messrs. F. H. S. Brown (B.E.A.); A. M. Browne (Hackbridge & Hewittic); A. R. Chapman (Babcock & Wilcox); Dr. I. R. Cox (Metropolitan-Vickers); Messrs. S. de Ferranti (Ferranti); E. W. Golding (E.R.A.); G. J. Gollin (Shell Petroleum); Dame Caroline Haslett (E.A.W.); Messrs. L. Howles (South Wales Electricity Board); J. K. Hunter (Sir Alexander Gibb & Partners); G. F. Kennedy (Kennedy & Donkin); L. J. Klimek (London University); Sir Ben Lockspeiser (D.S.I.R.); Messrs. H. J. London (Preece, Cardew & Rider); H. D. Morgan (Sir William Halcrow & Partners); A. J. Nicholas (South Wales Switchgear); H. Nimmo (Southern Electricity Board); W. B. Noddings (B.E.A.); J. D. Peattie (B.E.A.); H. V. Pugh (B.E.A.); W. F. Simonson (Watertube Boilermakers' Association); P. J. Squire (B.E.A.); R. G. Voysey (Ministry of Fuel and Power); and R. J. Welsh (English Electric).

The annual report of the World Power Conference for 1953 is now obtainable at 1s 6d from the offices of the British National Committee, 201–2, Grand Buildings, Trafalgar Square, W.C.2. In this it is announced that the fifth World Power Conference will be held in Vienna in 1956. Statistical Year Book No. 7 is due for publication next month. The accounts of the Central Office Maintenance Fund show an income for 1953 of £3,289 and an expenditure of £3,189, the balance reducing the accumulated deficit at the end of the previous year to £42.

INDUSTRIAL NEWS

Henley's Cable Contracts

UNDER A CONTRACT recently awarded by Belfast Corporation, W. T. Henley's Telegraph Works Co., Ltd., is supplying and installing approximately seven miles of 0·30 sq in 3-core 110 kV oil-filled cable, together with auxiliary cables and accessories. The installation will link the Belfast Power Station West with the system of the Electricity Board for Northern Ireland at Donegall substation. This 110 kV 3-core cable is the highest voltage 3-core cable of the oil-filled type manufactured in this country. The consultants for this contract are Merz & McLellan, Newcastle-upon-Tyne.

Among other contracts received by Henley's is one from the British Post Office for the land link in the Atlantic telephone scheme. Henley's will supply the line which will join the submarine cable at Newfoundland and carry the Atlantic link on to Nova Scotia. The cable, which will provide facilities for thirty-six simultaneous conversations, will consist of a central copper conductor surrounded with polythene insulation, taped, and armoured with protective steel wires, over which a jute serving will be placed.

Railway Electrification Survey

According to a special correspondent of *The Times*, the British Transport Commission has decided to make a survey of the main lines from Euston to Northampton, Birmingham, Stoke-on-Trent, Manchester and Liverpool with a view to ascertaining the economics of a.c. electrification at normal frequency as compared with the use of 1,500 V d.c. The survey is expected to take a year to complete.

Turbo-Generators for Canada

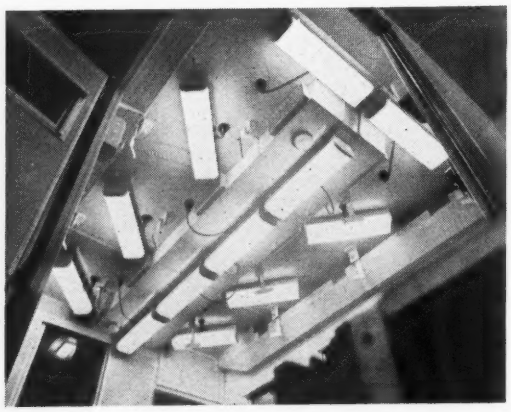
The Metropolitan-Vickers Electrical Co., Ltd., has received an order valued at over $1,000,000 from the Manitoba Hydro-Electric Board of Canada. The order, which was obtained in the face of international competition, is for two 33,000 kW steam turbo-generator sets. When installed they will be the largest steam turbo sets in the Province of Manitoba. The equipment will be manufactured at the Trafford Park Works, Manchester. Each set consists of a single-cylinder turbine operating with inlet steam conditions of 600 p.s.i.g. 825 deg F and driving a 13,800 V a.c. generator of the hydrogen-cooled type. The speed is 3,600 r.p.m. These are the first machines for installation at a new station of the Manitoba Hydro-Electric Board at Brandon near Winnipeg. Both are expected to be in commission by mid-1957.

National Radio Show

Sir Miles Thomas, chairman of the British Overseas Airways Corporation, is to open the National Radio Show at Earls Court, London, on 25th August. The exhibition will remain open until 4th September, and there will be a preview for overseas visitors and other special guests on 24th August. The exhibition for the first time is to include a demonstration by the B.B.C. of outside television broadcasts.

Lighting in Flight Simulators

Ten Sabre Jet flight simulators, for use in the training of pilots, are now being manufactured for the Royal Canadian Air Force by Redifon, Ltd., London. Eight of these are of mobile type, housed in 36ft long trailers of metal-framed construction built by Park Royal Vehicles, Ltd. A comprehensive air conditioning and temperature control installation is embodied during the construction, this being essential to the correct functioning of the simulator equipment. This equipment—which includes a replica of the Sabre cockpit, computing apparatus and control panels and recorders for the instructor—is designed to simulate flying emergencies and problems of navigation, without any of the hazard and at a fraction of the cost of actual flight. For the interior lighting of the trailers a system providing good illumination levels and of simple design was called for involving the minimum of special gear. After consultation with the Philips Lighting Design Service, a circuit using the basic components of the MCFD/U circuit—specifically designed for transport lighting applications—was put forward. Twelve batten type fittings, each equipped with two 2ft 20 W fluorescent lamps, were mounted in the section of the trailer housing the computers. Above the instructor's console in the next section of the trailer a further two fittings were installed. All of these special fittings have reeded Perspex covers.



Philips batten type fittings mounted in the section of the wagon containing the computing equipment of a R.C.A.F. flight simulator

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 os od
COPPER, H.C. Electro	ton £240 10s od
Fire Refined 99·70%	ton £239 os od
Fire Refined 99·50%	ton £238 os od
COPPER Tubes ..	lb 2s 3¾d
Sheet	ton £299 15s od
H.C. wire and strip ..	ton £272 os od
LEAD, English ..	ton £97 15s od
Foreign	ton £96 os od
MERCURY	flask £90 os od
TIN, block (English) ..	ton £721 10s od
ZINC, G.O.B. Foreign	ton £80 5s od
Electrolytic	ton £81 5s od
BRASS Tubes (solid drawn)	lb 1s 10¾d
Sheet	ton £245 10s od
Wire	lb 2s 6¾d
PHOSPHOR BRONZE Wire	lb 3s 10¾d
PLATINUM	oz £30 os od
RUBBER, No. 1 R.S.S. spot	lb 19d–19¼d

F.B.I. Overseas Scholarships

A booklet published by the Federation of British Industries, entitled "F.B.I. Overseas Scholarships—Training Overseas Engineers as an Aid to Future Exports," describes recent progress in the Federation's scheme for bringing to Britain young graduate engineers from the less developed countries for practical training.

Since the scheme began in 1950, forty-four scholars have arrived in this country, of whom nine have already completed their training and returned home. Eight more are expected shortly. Within the next year or two, however, the F.B.I. hopes that the number of scholarships awarded annually will rise to about 120. Since most of them are for a two-year period, this will mean that there will be at least 200 F.B.I. scholars in the country at any one time. Originally the scheme was confined almost exclusively to certain major Commonwealth countries. As a result of the mission to Latin America in 1952, which was led by Sir Arthur Fleming, chairman of the F.B.I. Overseas Scholarships Committee, scholarships were offered a year ago to the principal Latin American Republics, and scholars from Argentina, Chile, Colombia, Cuba, Mexico, Peru and Uruguay are among

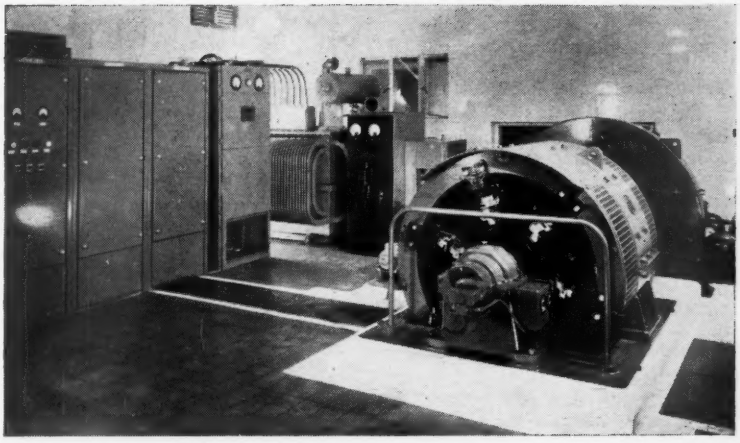
those who have already arrived. The scheme has now been opened to a number of other Commonwealth countries and to certain foreign countries in the Middle East and elsewhere.

Training School for Draughtsmen

In order to meet the shortage of trained draughtsmen the management of the Fraser & Chalmers Engineering Works of the General Electric Co., Ltd., has developed a plan whereby prospective draughtsmen are selected from among the apprentices before they have completed their course. Likely candidates whose inclination lies in that direction are given the opportunity to begin their drawing office training earlier than would normally be the case. Towards the end of their five years' apprenticeship they are transferred to the drawing office training school which has been instituted to give a thorough grounding in draughtsmanship. Aspiring draughtsmen attend the training school for a period of six months. The course of training is not restricted to drawing office practice. As an essential part of his instruction the trainee attends lectures in the work of the various departments. On the completion of his training he is transferred to the drawing office as a junior draughtsman. Still an apprentice, he is required, like all apprentices, to continue his attendance at a technical college.

Cooker Window Display

The North Eastern Electricity Board recently exhibited, in the main window of its headquarters at Carliol House, Newcastle, an interesting electric cooker display. A member of the staff actually built a cooker from the basic parts in the window, whilst the various parts were also exhibited with explanatory showcards. This operation continued at intervals throughout the day and visually demonstrated the materials used in B.N.E. cooker manufacture and the simplicity of assembly and dissembly, particularly from the ease of cleaning aspect. The display included a view of the B.N.E. factory together with a photograph of a local housewife who recently won five prizes in a cooking competition with her B.N.E. cooker.



Main mill control room at the Sheffield Works of Swift Levick & Sons, Ltd., with B.T.H. mill motor, contactor gear, and rectifier equipment

Steel Finishing Mill Drive

The British Thomson-Houston Co., Ltd., has recently commissioned the electrical drive for a 10in finishing mill installed in the Sheffield Works of Swift Levick & Sons, Ltd. The mill, which has been designed and built by the Brightside Foundry and Engineering Co., Ltd., is for producing high quality steel. It consists of a 10in bar mill of five stands, three stands consisting of 3-high rolls, with two stands of 2-high rolls for the finishing passes. The mill is driven through a gear box, with flywheel running at motor speed, by a 350 h.p., 350/840 r.p.m., d.c. motor. The incoming supply to the motor house is fed through 750 A distribution switchgear and a 280 kW transformer to a B.T.H. six-anode pumpless steel tank rectifier. An 800 A circuit breaker is incorporated in the rectifier cubicle for the outgoing d.c. supply. The main control panel is enclosed in sheet steel cubicles and, in addition to the main drive section, includes control for pinion oil, gear oil and Farval lubrication system. A comprehensive alarm system is incorporated to give visible and audible warning of loss of oil pressure or cooling air or high bearing temperature. The mill is controlled from an operator's control pedestal which is situated adjacent to the first mill stand.

A member of the staff of the North Eastern Electricity Board assembling a B.N.E. cooker in the window of the Board's headquarters during a recent cooker display

Plant for Jamaica

The Jamaica Public Service Co., Ltd., has placed a contract with the Harland Engineering Co., Ltd., for the generating plant for the new Rio Bueno power station, Jamaica. There will be one Harland 2,940 kVA, 3-phase, 6,900 V, vertical shaft generator driven by a 3,550 b.h.p. Harland–Morgan Smith Francis turbine operating under a head of 205ft. The turbine will be protected by a 36in diameter Harland–Morgan Smith rotovalve. As in the case of the Lower White River generating station, Jamaica, where a 6,700 b.h.p. unit was installed by the Harland Engineering Co., the Rio Bueno set will be designed for a frequency of 40 c/s; it will generate at 50 c/s when it is decided to change the frequency on the island.

Engineers' Handbook

The 1954 edition of the British Engineers' Association Classified Handbook of Members and their Manufactures, now published, has 700 pages of directory matter and advertisements. It includes a comprehensive list of manufactures, with more than 3,000 headings in four languages—English, French, German and Portuguese—specially classified to be of maximum assistance to purchasers of engineering equipment. Another section gives the trade names and marks of many manufacturers of engineering equipment. As in previous years copies of this silver jubilee edition are being sent gratis to selected buyers and agents in every country in the world which has business

with the British engineering industry, the distribution being made to no fewer than 118 countries.

Transformers in the Bahamas

We hear from Ferranti, Ltd., that its distribution transformers have been installed at Nassau in the Bahamas. The substation types were supplied from the transformer factory at Hollinwood and the pole-mounting types from the Canadian factory, the orders having been placed quite independently of each other. The two installations are situated only a few hundred yards apart.

Imports of Synthetic Rubber

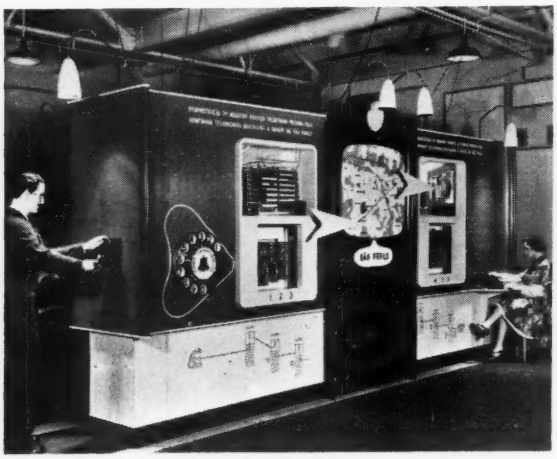
Arrangements for licensing small quantities of synthetic rubber from dollar sources until 30th June were announced by the Board of Trade in Notice to Importers No. 617 (dated 23rd December, 1953). The Board now announces that it is prepared to consider applications to import synthetic rubber from those sources during the six months ending 31st December next. Details of the method of applying for licences are given in Notice to Importers No. 655, issued by the Import Licensing Branch of the Board dated 4th June.

Telephone Exhibit for Sao Paulo

Dummies which go through all the actions of making and receiving a telephone call, speak to each other and finally replace the receivers form part of a special demonstration unit which was made by the Automatic Telephone & Electric Co., Ltd., Liverpool, and recently shipped to Brazil. This display unit, 20ft long, demonstrates the switching of a Strowger automatic telephone call and is intended for exhibition in Sao Paulo as part of the city's fourth centenary celebrations. It has been manufactured for the Companhia Telefonica Brazileira to enable visitors to the exhibition to understand the operation of the Strowger automatic telephone equipment with which the Sao Paulo telephone network is being modernized and extended. Between now and June, 1955, automatic equipment for 26,000 subscribers will be supplied.

The unit comprises a map of Sao Paulo flanked by small scale models of two automatic telephone exchanges which are at opposite ends of the city. Selector mechanisms are mounted below each of the exchange models.

A telephone demonstration unit made by the Automatic Telephone & Electric Co., Ltd., which will be exhibited in Sao Paulo during the fourth centenary celebrations



Profit-Sharing Scheme

The annual profit-sharing meeting of Horace Green & Co., Ltd., Cononley, Keighley, and their employees took place in the works canteen on 26th May. The meeting was addressed by Mr. Horace Green (chairman), Mr. G. S. Green and Mr. George W. Green. The chairman thanked the workers for their loyal support throughout the year and announced a dividend of 14 per cent on wages paid.

Equipment for New Zealand

Among orders recently received by Line Equipment, Ltd., is one from the New Zealand State Hydro-Electric Department covering two 220 kV and fourteen 110 kV 600 A vertical break rotating isolating switches for Otahuhu substation.

Laxton's Builders' Price Book

With reference to the notice published in our 28th May issue relating to the 1954 edition of Laxton's Builders' Price Book, Kelly's Directories, Ltd., informs us that copies will not be available for distribution until towards the end of this month.

Careers in Engineering

Last week we saw a film with the above title, which has been prepared by the English Electric Co., Ltd., with the object of showing the young man what a career in engineering involves in the way of training and education. He is first of all shown how to make a start in one of the many branches of engineering and at the training centre it is explained that there are three types of apprentice: craft apprentice, student apprentice, and graduate apprentice. All three start in the training centre and after a few months they are ready to go into the works. The film then shows the types of work which all three will be doing until their apprenticeships end and concludes by outlining the many possibilities which the future holds in store. Copies of the film are available on loan to colleges, schools and other interested bodies.

Scottish Design Congress

In last week's issue we mentioned a paper read by Sir John Maud at the recent Scottish Design Congress at Edinburgh. During the Congress a group paper was presented by Mr. T. Coughtrie, chairman of the Belmos Co., Ltd., on "The Evolution of an Appearance Design for Electrical Control Gear" in which he gave a short account of the manner in which a simple range of equipment for the control of electrical power in industry and commerce was given a new form.

Railway Equipment Supplies

In our issue of 21st May we published a list of suppliers of railway electrical equipment. The following should be added to that list:—

Bruce Peebles & Co., Ltd.—Rectifier substation equipment.

Everett, Edgcumbe & Co., Ltd.—Special instruments for railway work.

Industrial Television

The first example of a miniature industrial television camera being used for display purposes can be seen on the "Stacatruc" stand (I.T.D., Ltd.) at the Mechanical Handling Exhibition which is at present being held at Olympia. The stand is arranged so that the six-sided office section is held in the air by five fork-lift trucks. In five of the sides of the office television sets show pictures relayed by the Pye camera mounted on a separate fork-lift truck.

Advertisement Corrections

In the Siemens-Schuckert (Great Britain) advertisement on page 157 of this issue the captions of the two blocks relating to the typical 15 A triple or double pole ironclad enclosure and the multi-way board with instruments have inadvertently become transposed.

Due to a price change, as from 1st June, the cost of the 40 W 4ft lighting fitting offered in the Ediswan advertisement on page 41 of this week's issue, should read £5 6s 8d.

Catalogues and Lists

Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.—Leaflet announcing details of a new type of construction for "Cyclone" paddle blade centrifugal fans—series 4D (4DF/1).

Truvox, Ltd., 15, Lyon Road, Harrow, Middlesex.—Leaflet illustrating the "Truvox" radio jack which converts tape recorders and amplifiers into two-station radio receivers.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Three bulletins designed to make prospective users familiar with the company's current ranges of domestic and light industrial switchgear.

Aluminium Cable Sheath Extrusion

NEW PROCESS DEVELOPED BY B.I.C.C.

THE characteristics of aluminium sheaths for power cables are well known, and in Great Britain there is already wide experience of cables with sheaths produced by the tube-sinking method. However, the direct extrusion of aluminium sheaths has long been in the back of the mind of cable makers. During the past 25 years or so numerous efforts have been made to develop the process, but only of late have there been prospects of practical success.

After close study of the problems involved, and a great deal of preliminary experimental work, British Insulated Callender's Cables, Ltd., came to the conclusion a few years ago that the following conditions must be satisfied if the extrusion of aluminium sheaths was to take its place as a normal production process:—(*a*) The use of commercial grades of aluminium; (*b*) the use of solid billets; (*c*) low extrusion temperatures, preferably not exceeding 300 deg C; (*d*) the ability to produce sheathed cables in long continuous lengths; (*e*) satisfactory welds between successive billets; (*f*) minimum charging time to prevent overheating of the cable while stationary in the press; (*g*) avoidance of deformation and metallurgical features at "stop-marks" (i.e., the point on the sheath which is within the die when the cable is stationary for recharging).

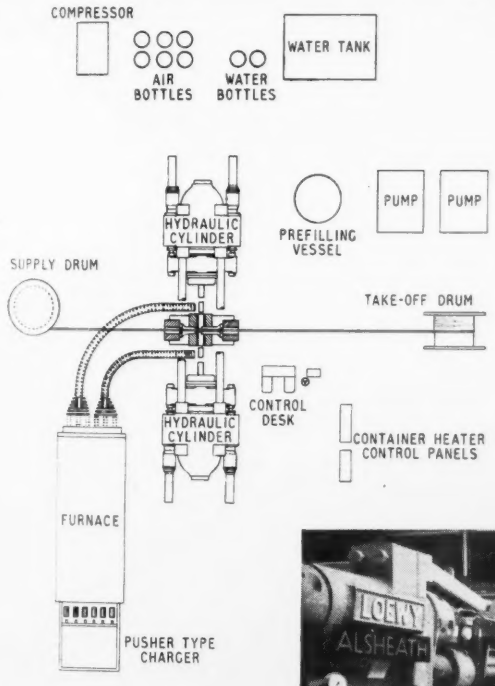
No existing type of press was available, which combined all these features, so B.I.C.C. and the Loewy Engineering Co., Ltd., joined forces in the development of an extrusion press which would provide the facilities required. The result of their combined efforts is the "Alsheath" press, made by the Loewy Engineering Co., Ltd., and installed at Prescot, which is the subject of patents and patent applications in Great Britain and other countries.

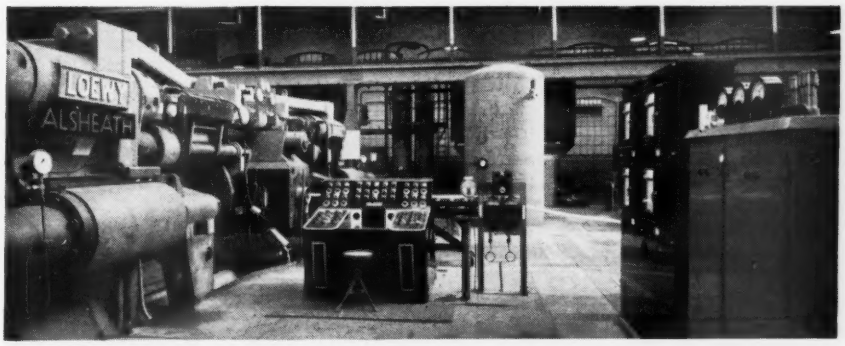
This press is believed to be unique. It is hydraulically operated with two horizontally opposed cylinders each of 45in diameter, operating at a pressure of 4,280 lb/sq in, and each giving nominally 3,000 tons capacity. Twin billets are extruded through a common core and die, to give sheaths ranging from 1·4in diameter to 3·5in diameter.

The cable passes through the press at right angles to the axis of the cylinders. This permits the use of solid billets and reduces to a minimum the length of cable exposed to the heat of the press. The extrusion tools are mounted in such a way that they retain their positions and the gap between them remains constant, independent of elastic deformation due to expansion or contraction under heat. The extruded sheathings are therefore free from weakness at "stop-marks." Special controls ensure that the speed of extrusion from the two containers is constantly balanced. Mechanical loading facilities have brought down the recharging time to a matter of seconds. Special attention has been devoted to the prevention of air inclusions. All major movements are controlled by servo-operated valves from a central pulpit providing for fully automatic control or for individual control as desired.

Trials so far indicate that all the initial objectives are being met and the press is approaching the stage when it will take its place as a routine tool in cable manufacture. Enough cable has been sheathed to show that the "stop-marks" are satisfactory from the dimensional and metallurgical aspects; they comply with the appropriate bend test requirements and they can withstand high hoop stress. The welds formed between successive billets (as distinct from "stop-marks") are not discernible in the extruded sheath.

With aluminium of 99·8 per cent purity and extrusion temperatures of 280 deg C, the extruded sheaths are in a lightly annealed condition. Tensile strength is 5·0 to 6·0 tons/sq in, and elongation on a length of two inches in the longitudinal direction of the sheath is 30 to 50 per cent, depending on diameter and thickness. The grain size is fine at all parts of the sheath including "stop-marks." These properties ensure that the springiness associated with cold working is largely eliminated.





Schematic diagram indicating the disposition of the various items of equipment of which the plant is composed (above) and (right) a close-up view of the front of the extrusion press and the control pulpit

Electrical Contractors' Conference

Discussions on Harrogate Papers

IN last week's issue we reported the proceedings at the annual conference of the Electrical Contractors' Association at Harrogate and gave abstracts of the two papers which were read.

The discussion on Mr. J. R. Halliwell's paper on "Business Opportunities for Electrical Contractors" was opened by Mr. R. A. Joseph (Wolverhampton) who referred particularly to the passage in the paper on motor repairs and re-winding. He doubted whether it would pay all contractors to undertake this work, which carried with it an obligation to provide a complete day and night service. Moreover, it called for a thorough electrical and mechanical knowledge, enabling the causes of breakdowns to be traced and future trouble to be avoided. Besides motors, the work would involve the repair of transformers, welders, rectifiers, etc. Such work could be tackled only on a proper scale and contractors should consider joint action in the form of a special firm for the purpose or the allocation of the work to one firm.

Mr. H. S. Wathes (Leicester) expressed disappointment that no mention had been made by Mr. Halliwell of agricultural work. Farmers were anxious to employ electrical methods and the electricity supply authorities were endeavouring to build up an agricultural load. If private contractors were unwilling to seize the opportunities the nationalized industry would do so. There was not a lot of money in it but it was worth doing. It was necessary to have an appreciation of the farmer's problems to be successful.

Importance of Service

Mr. A. S. Redvers Pratt (Bradford) thought that the making of money should be regarded as secondary to service. He found, however, that the public expected rather a great deal in the way of after-sales service. Referring to promises of a cheap and abundant supply of electricity, he pointed out that prices continued to rise. If the electricity supply authorities would concentrate on the production and distribution of electricity, leaving the manufacturer to make equipment and the contractor to install it, there might be an improvement.

Mr. H. F. Truman (Walsall) said that the obligations of the contractor should be stressed; daytime service alone was not sufficient and the Electricity Boards were acquiring a reputation for service. He urged contractors to "get in on the ground floor" in building work and not leave everything to the architect and the manufacturer. He did not think that contractors and retailers could take up radio and television work without setting up a special department. Electronics was a different matter and contractors should not lose opportunities in this direction. He did not believe in the "swings and roundabouts" idea; each department should stand on its own feet and separate accounts should be kept. Mr. Truman concluded by advising contractors to publicize themselves more than they did at present.

Mr. F. W. Blanshard (Purley) suggested that a better title for the paper might have been "How to Invest Your Money made from Contracting." He gave some examples of opportunities for contractors from recent observations. He agreed that night-time heating loads were a good source of business but they should not rely solely on the Boards' activities. Power factor correction business needed careful attention and there were valuable opportunities in electronics. A workshop need not be big but it should be completely equipped and in charge of a capable man. The speaker thought that hair dryers and f.h.p. motors were best left alone. He mentioned the possibilities of business in vacuum plant, lifting plant, etc. He advised members to steer clear of London exhibitions. In his opinion it was desirable to form separate companies for different classes of business.

Mr. C. J. Veness (London) referred to power factor correction equipment, pointing out that in many areas 0·85 lagging was acceptable to the supply authority. To have part of the p.f. correction equipment auto-controlled was a good thing.

New Developments

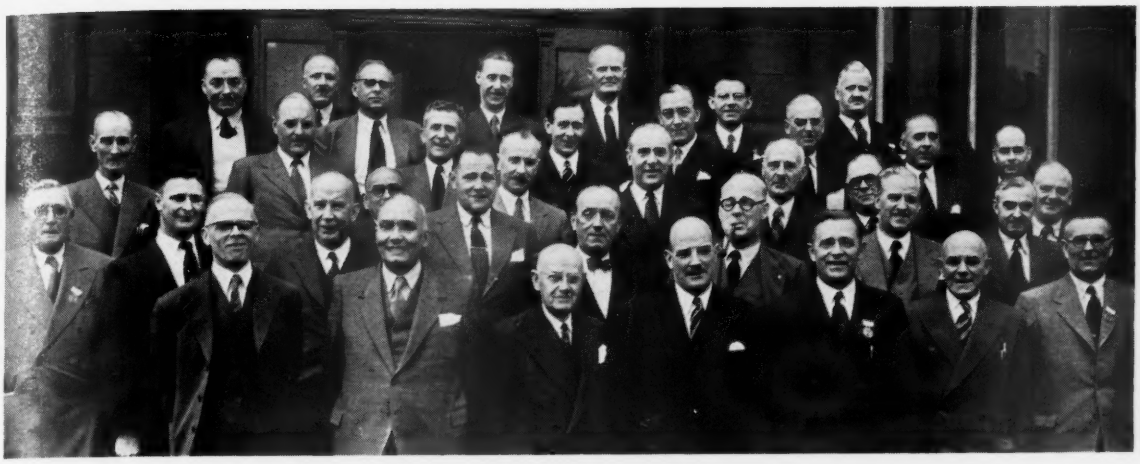
Mr. T. W. Heather (G.E.C.) drew attention to the large amount of research now proceeding upon semi-conductors which opened up wide new conceptions. We had to keep abreast of developments in other parts of the world. These devices would affect every branch of the industry. The fields of the physicist, chemist and electrical engineer were coalescing and contractors would be greatly affected. Mr. Heather contended that our minds were still ruled by wartime restrictions and we did not fully appreciate the opportunities which lay to hand.

Mr. R. Cussins (York) emphasized the need for effective contractors' showrooms to balance the strong publicity of the Electricity Boards. There should be a private-enterprise showroom in every town.

Mr. V. J. Stock (London) considered that contractors could buy most articles cheaper than they could make them in their own workshops, and Mr. A. J. Stirling (London) questioned the wisdom of Mr. Halliwell's offer to customers to put in p.f. correction apparatus free of charge and take the savings made in three years' operation.

Mr. E. Long (B.E.A.) claimed that the electricity supply industry was keeping contractors "on their toes," which was all to the good. Referring to the great expenditure on generating plant and distribution equipment, Mr. Long said that the more the electricity supply expanded the more the members of the Association "contracted." No doubt some contractors found Area Boards difficult but strict uniformity was not desirable.

In the course of his reply Mr. Halliwell said he agreed with Mr. Joseph that motor winding and servicing should be in the hands of specialists. Answering Mr. Wathes, he said that coming from Manchester he had had no experience of agriculture. He could not agree with Mr. Truman that radio could be divorced from other aspects of electronics. Mr. Blanshard could be assured that there was nothing to be frightened of in exhibitions. On the subject of low power factor penalties he said that in the North Western Area 0·9 minimum was stipulated. Mr. Halliwell told Mr. Heather that a section on transistors had been deleted from the paper in the process of revision. In spite of Mr. Stock's doubts about the wisdom of running a workshop he still maintained that it had value. Referring to Mr. Stirling's remarks, he said perhaps he would not



Members of the Council of the Electrical Contractors' Association at Harrogate

undertake to install p.f. correction apparatus on the same terms to-day. He concluded by welcoming Mr. Long, notwithstanding that the B.E.A.'s expansion might mean their contraction.

Lighting Applications

Mr. C. J. Veness presented his and Mr. A. H. Olson's paper, "Lighting Applications—The A.B.C. and L.S.D." and the two authors afterwards exhibited lantern slides of shop, industrial and domestic lighting and demonstrated the use of light in a model shop window.

The discussion was opened by Mr. J. Mortimer Hawkins (London) who said that the authors had applauded the introduction of the de luxe warm white lamp because of its near approach to tungsten lighting and asked if this was wise. If the general preference for tungsten lighting were ignored several colours would be needed for the various goods in a provision shop, for instance. He thought that E.L.M.A. should produce a universally acceptable standard fluorescent lamp. He expressed dissatisfaction with the authors' form of maintenance agreement and pointed out that electricians could not be employed on cleaning work. There was likely to be trouble from the awkwardness of cleaners. Careful records would have to be kept of the types of lamps in an installation so that the correct replacements could be sent. He thought that the authors' rather high figures of maintenance costs might have a bad effect.

Dr. H. H. Ballin (Thorn Electrical Industries) agreed that fluorescents had been welcomed as a desirable change from tungsten but there was now a tendency to return to the tungsten effect. The "mellow" lamp was a good compromise where the de luxe lamp was not suitable. After referring to the considerable improvement in the life of fluorescent lamps, the speaker put in a word for the group replacement scheme by which all the lamps in an installation would be changed at the same time. The contractor had a wide field in lighting, particularly in the use of fluorescent lamps in kitchens.

Mr. W. J. Jones (E.L.M.A.) praised the examples of lighting ideas which the authors had shown, some of which, he said, had been accepted internationally. He mentioned the low running cost of lighting windows and said that the capital cost was very small compared with other shopfitting charges. Contractors should rely upon the excellence of the lighting of their own premises to attract lighting business; it had been shown that between 1946 and 1951 electrical retailers had increased their lighting by 50 per cent. He considered that the lamp manufacturers had been very wise to keep the Lighting Service Bureau going.

Mr. D. L. Tabraham (G.E.C.) said that for the time being they would have to manage without revolutionary new light sources. They must be less conventional and deliberately set out to create "atmosphere" rather than worrying too much about intensities. Smaller commercial and industrial premises had been neglected; there were tremendous potentialities with combinations of fluorescent and tungsten lighting.

The President (Mr. S. L. M. Barlow) announced that there was no time for further contributions. The authors would make a very brief reply and reserve further points for correspondence or for publication in the Press.

Mr. Veness said that he and Mr. Olson had not set out to give a complete education in the various applications. They felt that the de luxe warm white lamp had filled a great need. Their maintenance agreement form was merely "the germ of an idea."

Mr. Olson said the cost of electrical work in shops was probably only 10 per cent of the total cost. He agreed with Mr. Tabraham's views on "atmospheric" lighting.

New President Installed

Mr. S. L. M. Barlow then introduced his successor as President, Mr. A. F. Plummer, assuring the members that the Council could not have made a better choice. Mr. Plummer had been a vice-president for three years and he would have been President this year if circumstances had not prevented it. He outlined Mr. Plummer's many services on behalf of the Association.

In acknowledging the honour conferred on him, Mr. Plummer said he was a man of peace and peace was what they needed—peace with the nationalized electricity supply industry, with the manufacturers and with the employees. In the majority of firms the employer-employee relationship was good and he hoped that this local feeling would eventually become national. Earlier fears of the unknown were being dispelled and their relations with the electricity supply industry had improved. There would be changes in their relationships with manufacturers during the coming year because of the Government's acceptance of the Monopolies Commission's recommendations with regard to the cable industry and because present arrangements were not too satisfactory.

Mr. Barlow concluded the proceedings by expressing the Association's thanks to all who had helped to make the conference a success.

GENERATION AND DEVELOPMENT

B.E.A. Contracts

CONTRACTS placed by the British Electricity Authority during the past month for power stations, transforming stations and transmission lines amount to £4,496,830. The principal items are as follows:—

Brighton "B" power station: High pressure pipework and valves.—C. A. Parsons & Co.

East Yelland, near Barnstaple: High pressure pipework and valves.—C. A. Parsons & Co.

Portishead "B", near Bristol: Foreshore works.—Charles Brand & Son.

South Denes, Yarmouth: Foundations, river works, culverts and outfalls.—Peter Lind & Co.

Ocker Hill, Tipton, Staffs.: Main civil engineering work.—Leamore Construction Co. High pressure steam and feed pipework and valves.—Aiton & Co.

Ferrybridge "B", Yorks.: 6·6 kV compound filled auxiliary switchgear.—South Wales Switchgear.

Mexborough, Yorks.: Structural steelwork.—Heenan, Beddow & Sturmey.

Chadderton, Oldham: Two 60,000 kW turbo-alternator sets, condensing and feed heating plants.—Metropolitan-Vickers Electrical Co.

Hartshead, Stalybridge: 33 kV switchgear.—Ferguson Pailin.

Stella West 275 kV substation, Newcastle-upon-Tyne: Site and foundation works.—Sir Robert McAlpine & Sons (Newcastle-upon-Tyne).

Windyhill substation, near Glasgow: 132 kV 2,500 MVA switchgear.—Metropolitan-Vickers Electrical Co.

Cheaper Electricity in Ulster

Reductions in charges announced by the Electricity Board for Northern Ireland include lower coal clause payments under all tariffs, consequent upon the increased efficiency of new generating plant. The new charge is 0·01d per kWh (against 0·011d) for every shilling by which the cost of coal at Ballylumford and Belfast generating stations exceeds 65s a ton. In an effort to promote wider rural electrification, the guarantee to use electricity up to an amount representing 17 per cent of the capital involved is reduced to 16 per cent. A third concession is the termination of all simple hire agreements in existence at 31st December, 1939, the hired appliances or wiring installations becoming the property of the hirer without further payment. It is estimated that the reduction in revenue this year will be £33,610.

Yorkshire Industrial Tariffs

From the beginning of October new standard industrial tariffs are being introduced by the Yorkshire Electricity Board, as follows:—

BLOCK TARIFF (I.1) where the estimated m.d. does not exceed 50 kVA: For the first 50 kWh per quarter per kVA of assessed demand, 4½d/kWh; for the next 300, 1¾d/kWh; for the next 400, ¾d/kWh; and thereafter, ¾d/kWh. An additional 2s 6d a quarter will be charged for supplies through prepayment meters.

TWO-PART TARIFF (I.2) for consumers having an estimated m.d. not less than 5 kVA: Annual demand charge (h.v. supplies) of £4 7s 6d/kVA for the first 100 kVA of m.d., £4 2s 6d for the next 150, £3 17s 6d for the next 250 and £3 15s thereafter, or a monthly demand charge of 8s 9d, 8s 3d, 7s 9d and 7s 6d, respectively. For l.v. supplies the annual terms are 5s and monthly 6d more than those for h.v. supplies. The "unit" charges are 0·675d (h.v.) or 0·725d (l.v.) for each of the first 250 kWh a month per kVA of m.d. in that month, 0·625d (h.v.) or 0·675d (l.v.) for each of the next 100 kWh, and 0·575d (h.v.) or 0·625d (l.v.) thereafter, subject to a fuel price adjustment of 0·0007d (h.v.) and 0·00075d (l.v.) per kWh for each 1d variation in the price of fuel per ton from the basic figure of 60s.

These tariffs are available as alternatives for industrial consumers with demands between 5 and 50 kVA.

The Board has also decided to vary the combined premises tariff as from 1st July. In future consumers owning or occupying combined commercial and domestic premises having a total estimated m.d. not exceeding 50 kVA may elect to be supplied either under the combined premises tariff or under the domestic and the commercial and miscellaneous premises tariffs, respectively, where there are separate circuits.

Mr. S. F. Steward (left), chairman of the South Western Electricity Board, presenting an automatic electric tea-maker to Mr. W. J. Chase, of Newbridge Farm, East Huntspill, the 100,000th consumer to receive a supply in the Taunton Sub-Area ("Electrical Review," 4th June, p. 1064)

Bath and West Show

In view of Press reports concerning electricity for the Bath and West Show, Mr. S. F. Steward, chairman of the South Western Electricity Board, last week issued a statement pointing out that the Board had not been asked to quote terms for extending a supply to the showground at Exeter. He added that had the Board been asked to submit a tender its price for taking a supply to the showground would have been less than a quarter of the figure of £4,000 mentioned in some reports.

Electricity in the Lake District

New moves to take a supply of electricity to rural Lakeland were outlined to a recent meeting of the North-East Lakeland Committee of the Electricity Consultative Council. It was stated that electrification schemes involving a capital expenditure of £1,642,000 had been submitted to the Board for approval, including the provision of supplies to 2,446 farms and 2,627 other premises. Mr. J. E. Shepherd, manager of the Lakeland Sub-Area, said he had asked for a capital sum of £750,000 to be spent at the rate of £150,000 a year for the next five years. If this were approved it might be necessary to obtain outside assistance in tackling the programme.

Portuguese Power Station

The first of the two 61 MVA 15·5 kV generating sets at the Cabril power station of the Hidro-electrica do Zezere in Portugal was commissioned on 20th May, this fulfilment of the original programme being a considerable achievement on the part of the company and the contractors. The dam, which is 433ft high, is one of the highest in Europe. The mechanical and electrical equipment has been supplied and installed by the English Electric Export and Trading Co. and Metropolitan-Vickers Electrical Export Co., known in Portugal as the "British group." This group also supplied similar equipment at the Castelo do Bode power station about 43½ miles downstream of Cabril on the Zezere River. The turbines each have an output of 74,800 b.h.p. at the maximum head of 397ft approximately and the generators give 61 MVA as a maximum continuous rating. The three-phase transformers are rated at 61 MVA 15·5/165 kV. There are two generator transformer circuit breakers and one feeder breaker, each of the airblast type, for 165 kV.

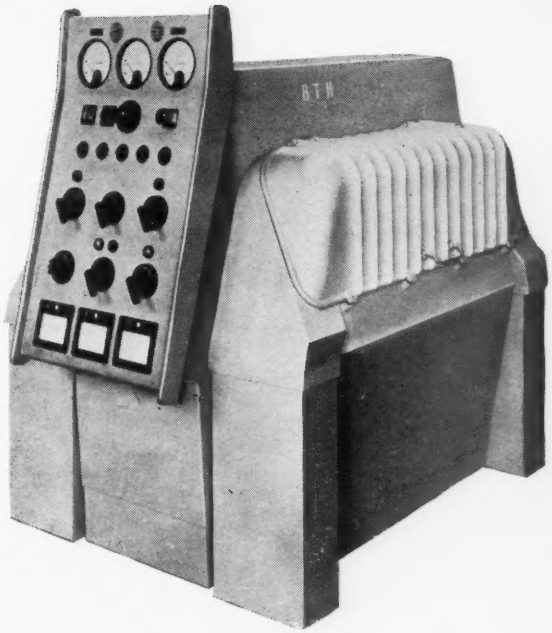
Woodhead Tunnel Opened

On 3rd June the Minister of Transport (Mr. Lennox-Boyd) opened the three-mile long Woodhead Tunnel on the electrified railway between Manchester and Sheffield. From 14th June electric trains will run from Manchester to Penistone where steam locomotives will take up; the rest of the stretch to Sheffield will be electrified by September for passenger traffic and freight traffic will be electrically hauled next year. It is stated that this electrification will save about 100,000 tons of coal a year.

THE CONTACT RECTIFIER

Basic Principles of Design and Operation

By D. R. SMITH, M.A., Graduate I.E.E.*



THE contact rectifier is a device employing mechanically operated switches to convert alternating to direct current. Its principal advantage is a high efficiency, which makes it very attractive to the electro-chemical industry, where the cost of electrical power is a very large factor in the total cost of the product. The mercury arc rectifier, which, on account of its higher efficiency, has largely supplanted rotating machinery as a means of converting alternating to direct current, has an arc drop of about 20 V, which makes it relatively inefficient at low voltages.

A fundamental requirement of the contact rectifier is that the contacts operate at the frequency of the a.c. supply. Since a small amount of arcing will greatly reduce contact life when repeated at the rate of 3,000/min, it is essential that the contact current should be substantially zero when the contact opens. This is the basic difficulty which has only comparatively recently been overcome. The solution to the problem lies in the use of the commutating reactor, introduced by Dr. Koppelmann in Germany about 1935. This reactor flattens the contact current in the neighbourhood of current zero, and permits the contact to open with substantially zero current in it.

Fig. 1 shows a three-phase rectifier in which the rectified current flows back through the star point of the transformer secondary winding. Valve elements X_1, X_2, and X_3 permit current to flow in the direction of the arrow only. Under these conditions the three phases supply the load in sequence, and the output voltage of the rectifier is the ripple made up by the crests of the phase voltages. However, the transformer windings have inductance so that the load current cannot transfer instantly from one phase to the next, and for a finite time two phases carry

* British Thomson-Houston Co., Ltd.

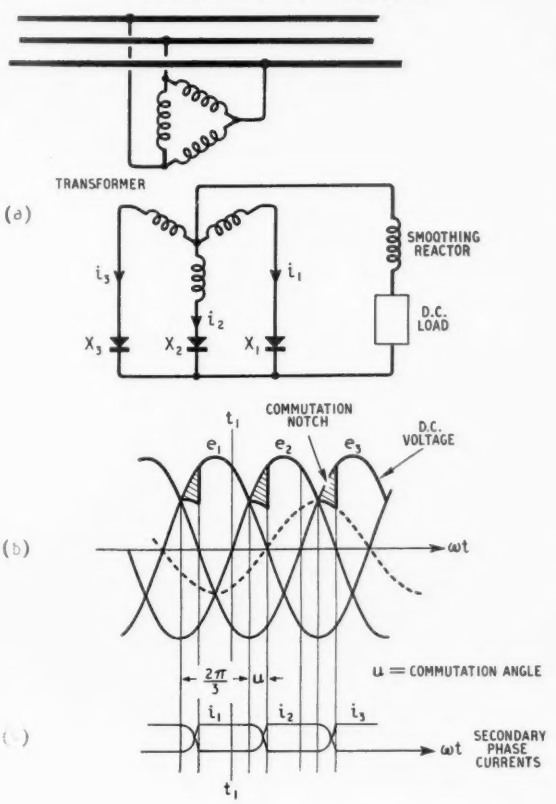
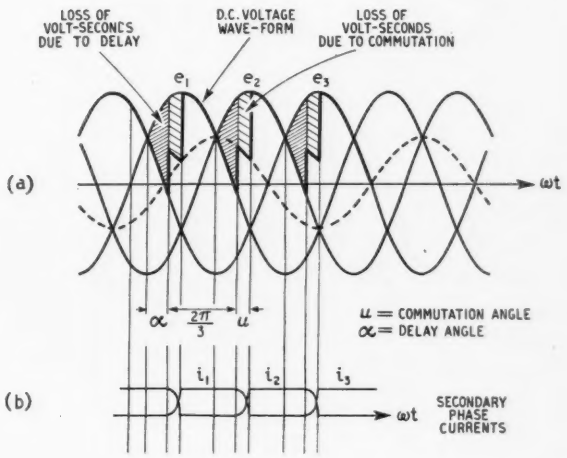


Fig. 1 (left).—Three-phase rectification

Fig. 2.—Rectifier waveforms with delayed commutation



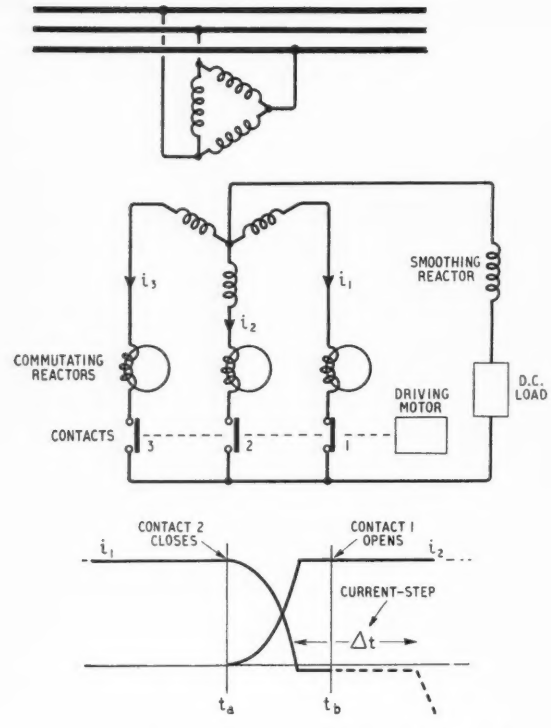


Fig. 3 (above).—The effect of using a saturating reactor

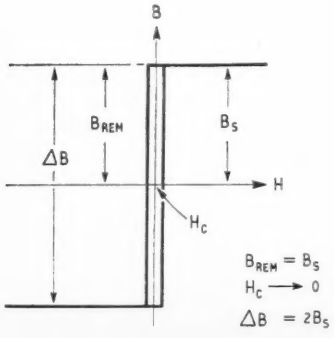
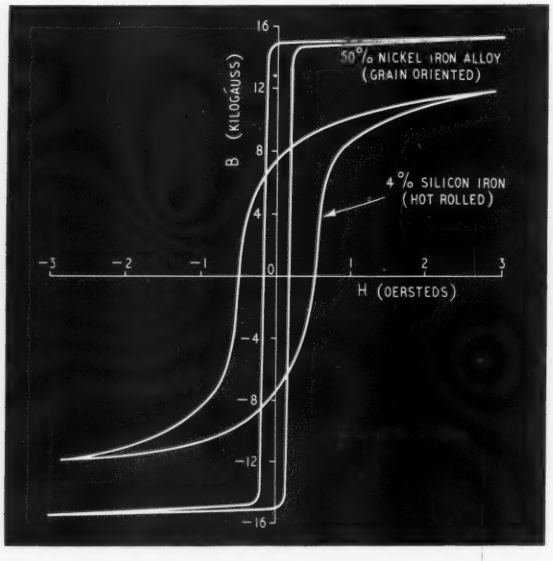


Fig. 4 (left).—An ideal B-H loop

$B_{REM} = B_S$
$H_C \longrightarrow 0$
$\Delta B = 2B_S$

Fig. 5 (below).—Static B-H loops of sample cores



current simultaneously. The process of transferring current from outgoing to incoming phase is known as commutation. It produces the notches shown in the voltage waveform.

Commutation normally begins at the instants of intersection of the phase voltages, but delayed commutation is widely used in mercury arc rectifiers as a means of voltage control. As the delay is increased the output voltage falls as shown in Fig. 2. This delay is obtained by the use of grid control in the case of the multi-anode tank and by phase control of the igniter firing circuit in the case of the ignitron.

The Commutating Reactor

In the contact rectifier the valve elements are replaced by switch contacts. The contact of the incoming phase is closed to start commutation, while the contact in the outgoing phase is opened several degrees later when the current in it reaches zero. However, in a large rectifier supplying perhaps 15,000 A, the rate of change of current during commutation may be as high as twenty million amperes per second. To open the contact at current zero would therefore require a precision of switching quite unobtainable in practice. If, however, a saturating reactor with a sharp point of saturation is connected in series with the contacts, a step is produced in the current waveforms as shown in Fig. 3. This step is a region of low current during which the contact of the outgoing phase can be opened with safety.

The current waveforms in Fig. 3 show a commutation from phase 1 to phase 2. The contact of the incoming phase closes at t_a, and immediately current begins to transfer to phase 2. When i_1, the current in the outgoing phase, reaches a small value the reactor in phase 1 becomes unsaturated, and its high inductance holds the current constant until its magnetization is reversed. The contact of phase 1 is opened at instant t_b, during the current-step.

To produce a well-defined step in the current waveform the commutating reactor must have a very high inductance when unsaturated and a very low inductance when saturated. Furthermore, the change from the saturated to the unsaturated state must occur very suddenly. Such a characteristic is obtained if the core of the reactor has a narrow rectangular B–H loop as shown in Fig. 4. This characteristic, if only happily it were available, would be ideal. The magnetizing force H in the core is proportional to the current in the winding. Hence the current-step corresponds to the vertical flank of the B–H loop, where $H = H_c$.

The sudden increase of the inductance at the knee of the characteristic is equivalent to opening a switch in the circuit at zero current. It is interesting to note that it is now the commutating reactor which does the work of chopping off the commutating current, while the contact acts as an isolating switch.

It is well known that a nearly rectangular B–H loop is shown by single crystals of some magnetic materials when magnetized along a preferred crystal axis. This characteristic is sometimes retained to a considerable extent in specimens of these materials having a high degree of crystal orientation. By far the most satisfactory material at present available is a 50–50 nickel-iron alloy, in which the crystals are oriented by a cold reduction of about 95 per cent followed by a carefully controlled high temperature anneal at about 1,050 deg C in an atmosphere of dry hydrogen. This material was first developed in Germany about 1935 under the name of Permenorm 5000–Z, and now available in this country as H.C.R. alloy. The material is produced as a continuous strip about one inch wide and from 0·01 to 0·001 inch thick in a spiral coil.

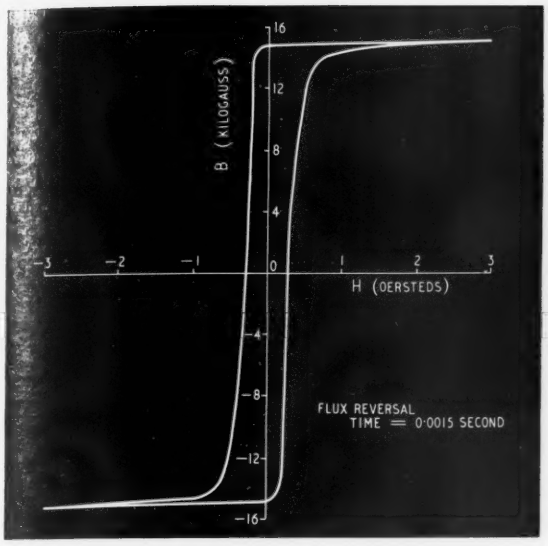


Fig. 6.—Dynamic B-H loop of sample 50-50 Ni-Fe alloy core

This material is unfortunately extremely sensitive to mechanical shock and must be handled with great care at all times. Fig. 5 shows a typical hysteresis loop of this material with a hot rolled transformer iron for comparison.

The length of the current-step is the time required to reverse the flux in the reactor and is given by the equation

$$\int_{t}^{t+\Delta t} e_c \, dt = a.\,n.\,\Delta B \,.\, 10^{-8} \text{ voltseconds}$$

where t is the instant when the current-step begins, e_c is the sinusoidal commutating voltage, a is the net cross section of the core in centimetres squared, n is the number of turns of the reactor winding, ΔB is the change of B in the core (see Fig. 4) and Δt is the step-length.

Therefore, Δt varies with t and hence with the delay angle and commutation angle. It is convenient to refer to the rating of the commutating reactor in terms of rectifier kVA and the step-length so it is desirable to find a definition for the latter which is independent of operating conditions. Δt_{min} is defined as the time for flux reversal when a voltage equal to the peak of the commutating voltage is applied to the rectifier.

$$\Delta t_{min} = \frac{a.\,n.\,\Delta B \,.\, 10^{-8}}{e_{cmax}} \text{ seconds}$$

The value of Δt_{min} must be such that under all operating conditions the contacts open during the current-step. Allowance must be made for the variation of load, transient disturbances of the a.c. supply, and mechanical errors arising for example from thermal expansion of the push rods and erosion of the contact faces. On the other hand, the commutating reactors are not made larger than is absolutely necessary on account of the extremely high cost of the core material. In practice it is usual to make Δt_{min} from 1 to 1·5 milliseconds.

The B–H characteristic of the core material under dynamic conditions differs considerably from the static or hysteresis loop, due to eddy currents and stray losses. The value of B in the dynamic characteristic is obtained by integrating the voltage across a search coil, while H is proportional to the magnetizing current. The characteristic can either be obtained by integrating between limits, using a synchronous switch, or else by continuous integration using an RC integrating circuit. In the latter case, the characteristic can be displayed on a cathode-ray oscilloscope.

A typical dynamic loop is shown in Fig. 6, from which it can be seen that the apparent coercive force (H when B = 0) is approximately twice that of the hysteres is loop. Furthermore the knee of the loop is less rectangular. These undesirable features become more pronounced as the rate of change of flux, and the thickness of the material, increase. It has therefore been usual to make the cores from strip of from 0·001 to 0·006 inch thick.

The B–H characteristic of the core material approaches rectangularity only if the direction of the magnetization coincides with the direction of rolling, and if air gaps are avoided in the magnetic circuit. The cores of the commutating reactors are therefore in the form of spiral rings wound from thin strip. The core is protected by an annular box of non-magnetic material, on which the toroidal winding is supported. This winding consists of a large number of pancake coils connected in series and parallel as required, the parallel connections being made by two busrings. Fig. 7 shows a typical arrangement, with auxiliary windings brought out to a terminal board. The reactors are usually mounted in towers one above the other with forced air cooling.

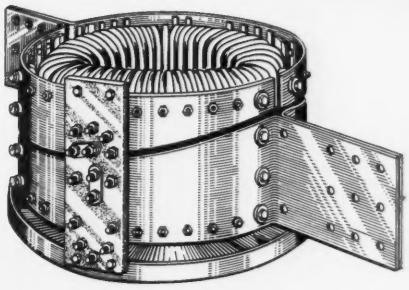


Fig. 7.—A commutating reactor

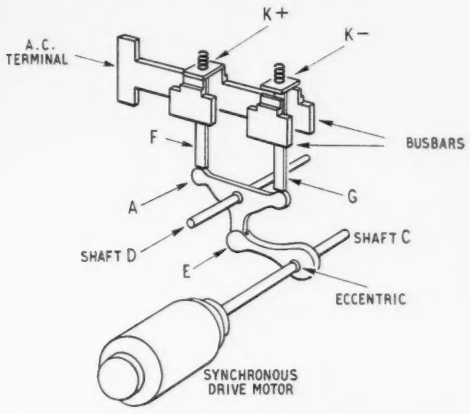


Fig. 8.—Typical arrangement of a contact mechanism

Contact Mechanism

The contact rectifier mechanical unit is sometimes compared with the valve operating mechanism of a motor car engine. Some impression of the severity of the duty imposed on the mechanical unit may be conveyed by the fact that at 3,000 r.p.m. an equivalent car would run about

50,000 miles a month at 60 m.p.h., with an annual overhaul. The contacts have to carry a current of over 4,000 A and require either forced air or water cooling.

The contacts themselves consist of two fixed contacts bridged by a moving contact. The contact pressure is provided by a stiff spring which exerts a force of about 200 lb. Pressure type contacts are used in preference to sliding contacts, such as a carbon brush on a commutator, because of the considerably higher conductivity of metallic contacts. This results in a much more compact contact arrangement with at the same time a smaller power loss. The dielectric strength of an air gap is very high, so that the opening contact can withstand the re-striking voltage almost immediately the contact surfaces separate.

Fig. 8 shows one method by which the contacts have been driven. The rocker arm A is pivoted at D on needle-roller bearings, and is caused to oscillate by the eccentric on shaft C and connecting rod E. The shaft C is driven in synchronism with the supply voltage by a synchronous motor. Push rods F and G which have a stroke of about 0·15in, operate two contacts whose motions are displaced 180 deg in phase. The other four contacts of a three-phase unit are operated by two similar rocker arms, driven by the same shaft C, but with their eccentrics displaced 120 deg and 240 deg from that of A. The rocker arms are also eccentrically mounted on shaft D, so that by rotating this shaft the effective length of all the push rods can be varied simultaneously, thus varying the duration of contact.

It is desirable to be able to adjust the lengths of the push rods individually while the unit is running, so that the inevitable variation in contact timing occurring during operation can be corrected while the rectifier is on load. One method of doing this is to make the push rods in two parts screwed together, so that by rotating one part relative to the other the length of the push rod can be increased or reduced as desired.

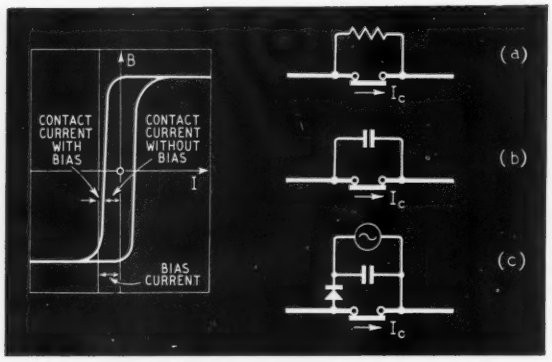


Fig. 9.—Premagnetization and by-pass circuits

Contact Life

The life of the contacts is limited almost entirely by the electrical erosion at make and break, which in time will so change the contour of the contact faces that a backfire occurs. To reduce this erosion it is desirable to keep the contact current at make and break as small as possible, and to provide arc-quench or by-pass circuits across the contacts. The choice of contact material is restricted by the high currents to be carried. The materials which best stand up to contact arcing, for example tungsten, cannot be used because of their high contact resistance. At present the most widely used material is silver.

Consider first the erosion caused when the contact opens. The current in the contact at this instant is the magnetizing current of the unsaturated commutating reactor, so that if this magnetizing current is supplied from a separate source the contact current is reduced accordingly. A compromise which can easily be effected is to bias the reactor with a constant current, which in the case shown in Fig. 9 reduces the contact current by about seventy-five per cent.

The simplest by-pass circuit is a non-inductive resistor to which the contact current can transfer as the contact opens. Unfortunately, to be effective the resistor must be small, with the result that the current flowing due to the circuit voltage when the contact is open causes as much as 0·5 per cent loss of overall efficiency of the rectifier. There is no appreciable loss with a capacitor shunt, but this may resonate with the residual circuit inductance, causing troublesome oscillations of the step-current. Furthermore, the capacitor discharges through the contact at make, causing considerable burning of the contact faces. Both these troubles are avoided if a metal rectifier is connected in series with the capacitor to prevent it discharging through the contacts. An auxiliary bias voltage is provided so that the metal rectifier operates on the flat part of its characteristic.

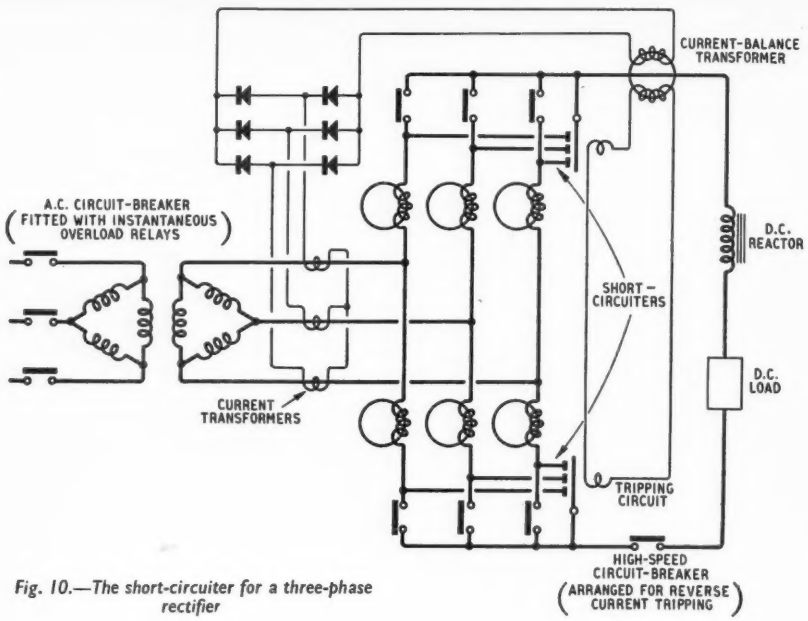


Fig. 10.—The short-circuiter for a three-phase rectifier

To reduce erosion at make the initial inrush of current to the closing contacts must be limited to about 3 A, until any tendency to contact bounce has ended and the full contact pressure has been established. It is therefore necessary to absorb the commutating voltage, which would otherwise cause a rapid increase in the contact current, by means of a saturable reactor similar to the one producing the current-step at opening. The period of low current, from

the instant when the contacts first touch until the beginning of commutation, is known as the closing-step. Experience has shown that the closing-step should not be less than about 100 μsec. This closing reactor is usually combined with the main commutating reactor.

The Short-Circuiter

The rectifier contacts are designed to operate purely as isolating switches; they have no rupturing capacity and cannot be used as circuit breakers. If a contact is opened while carrying an appreciable current, the opening contact will draw out an arc. The resultant ionization of the air in the contact gap so reduces the dielectric strength that the open contact may be unable to withstand the circuit voltage, in which case a backfire occurs which will only be cleared by the a.c. and d.c. switchgear.

The phenomena of backfire is familiar in connection with mercury arc rectifiers, where adequate protection is provided by quick operating switchgear. The danger is more acute with the contact rectifier, both because of its large current rating (with a correspondingly large short circuit current), and also because of the small size of the contacts themselves. To safeguard the contacts a special high-speed device is employed, which diverts the current from them until the switchgear operates. This device, which is known as the short-circuiter, operates within one millisecond of the commencement of a fault short-circuiting all the reectifier contacts, thus limiting damage to one or at most two contacts.

The connection of the short-circuiter for a three-phase rectifier in shown in Fig. 10. The switch comprises three fixed contacts connected to the a.c. side of the three contacts of one d.c. busbar, and a moving contact connected to the d.c. busbar. The moving contact is held open against the action of a stiff spring by an electro-magnetic latching system which, in the event of a fault, is released by the current in the tripping coil.

The tripping impulse is applied by a special current-balance transformer, which is mounted on the outgoing d.c. busbar (Fig. 9). The ampere-turns produced by the output current of the rectifier are balanced by the ampere-turns introduced by a multi-turn winding supplied from the a.c. side of the rectifier through current transformers and a three-phase selenium rectifier unit. The ampere-turn balance is so arranged that in normal operation the core is just saturated; in the event of a backfire the rectifier output reverses, and the balance is upset in the direction to reverse the flux in the saturable core. The reversing flux induces a pulse of voltage in an auxiliary winding on the core; this pulse is used to trip the short-circuiter. The ampere-turn balance can be made very sensitive so that the tripping impulse is applied in the very early stages of a backfire, before large currents build up.

A Complete Rectifier Equipment

The main and auxiliary connections of a three-phase contact rectifier unit capable of supplying up to 7,500 A and 400 V are shown in Fig. 11. A complete equipment usually consists of two such units in parallel, supplied from a single transformer with two secondary windings on a common core. If one secondary is connected in star and the other in delta, using an interphase transformer, then the lowest harmonic in the rectifier output is the twelfth.

The base-load resistance, shown in Fig. 11, is provided to ensure that the commutating reactors shall be saturated throughout their current conducting period until the end of commutation. This is essential if the current-steps are to occur at the correct instants during the cycle. The base-load is disconnected when the rectifier is on load.

The method of starting up a contact rectifier is complicated by the fact that, if the full a.c. voltage were suddenly applied to the main transformer, the resultant magnetizing current surge would cause an immediate backfire. One method by which this difficulty can be overcome is to use a series starting resistance, and so apply the voltage gradually.

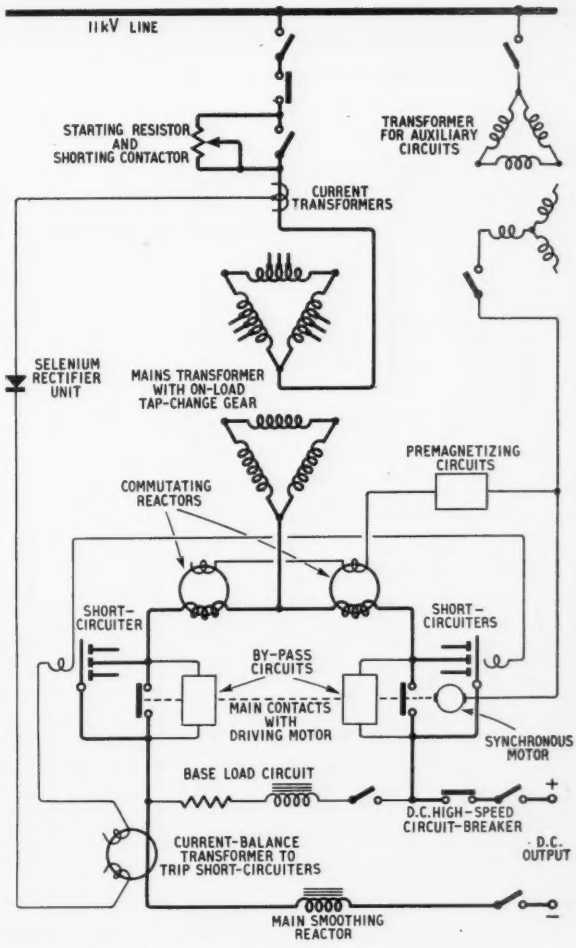


Fig. 11.—Simplified circuit of a 7,500 A 400 V contact rectifier

The rectifier output voltage can be controlled by delaying the start of commutation, as described in connection with Fig. 2, but if the rectifier is to run for long periods below its rated voltage, it is preferable to obtain the voltage reduction by means of tappings on the main transformer. This is because of the large voltage harmonics and poor power factor at large angles of delay, and because conditions in the rectifier are inherently more exacting when the delay is large.

The very high efficiency at low voltages (the outstanding advantage of the contact rectifier) arises from the absence of both the forward voltage drop in the valve elements of other polyphase rectifiers, and the friction, windage and iron losses which are present in rotating machines. A full-load efficiency of 97·2 per cent has been claimed for a large rectifier supplying 7,000 A at 400 V, while at lower voltages an efficiency of 95·5 per cent has been claimed on a rectifier rated at 6,000 A at 120 V. About half the total losses occur in the main transformer; the remainder consists of losses in the commutating reactors, the contacts, and the auxiliary equipment.

A comparison with the efficiencies of other converting

equipment is shown in Fig. 12, from which can be seen the considerable advantage in efficiency of the contact rectifier at voltages up to about 800 V.

The ability of the contact rectifier to ride through transient disturbances on the a.c. or d.c. networks is inherently limited. This is because the response time of the mechanical part of the equipment is too sluggish to follow sudden electrical disturbances, and once the contacts open elsewhere in the cycle than during the low-current step a backfire is almost certain to occur. On the other hand the length of the current-step is quite adequate to cover normal conditions and can be increased in those cases where exceptional disturbances are expected.

The current and voltage waveforms of a contact rectifier are similar to those of a mercury arc rectifier using the same connection. The power factor at minimum delay lies between 0·80 and 0·90, depending on the quality of the core material of the commutating reactors, and on the total circuit reactance including the air-cored reactance of the commutating reactors.

In addition to its high efficiency, an important advantage of the contact rectifier is its compactness and the light weight of its components, which bring a valuable saving in the cost of the buildings and foundations. This arises first because of the very high current density in the contacts which permits single units to be built for currents of from 10,000 to 20,000 A, and second because of the absence of heavy rotating machinery.

The contact rectifier has been developed along the lines indicated in this article, in response to the demand of the electro-chemical industry for a heavy-current rectifier of high efficiency at low voltages. It is particularly suited to service where the a.c. supply and the d.c. load are steady.

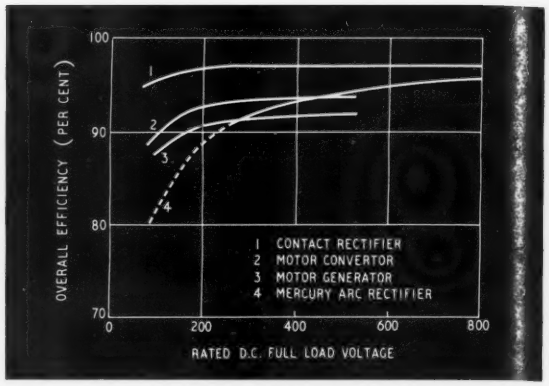


Fig. 12.—Full load efficiencies of convertors for 15,000 A d.c.

Some idea of the extent to which the contact rectifier has established itself since the war can be gauged from the fact that the total capacity of contact rectifier equipments installed or on order throughout the world is believed to exceed one million amperes.

The author wishes to thank Dr. J. C. Read and his colleagues for help and encouragement during the writing of this article, which is based on a paper read by the author at the B.T.H. Summer School, 1952, and to the B.T.H. Co., Ltd., for permitting publication.

Electricity in Mines

THE report of Mr. J. Cowan, H.M. Principal Electrical Inspector of Mines, for the year 1951 has just been published by H.M. Stationery Office, price 1s 6d. During the year H.M. Electrical Inspectors made 1,527 inspections at mines of which 796 were on the surface and 731 were underground. Included in these numbers are over 70 inspections following the explosions at Easington and Eppleton collieries. The installation, especially at Easington Colliery, was extensive and involved prolonged and detailed examination of electrical apparatus. In addition, 43 inspections were made at metalliferous mines and 57 at quarries. Inspectors were engaged on 296 occasions in attending conferences, inquests and inquiries, visits to manufacturers' works and other special duties.

As a member of the British delegation to the International Commission on Illumination, Mr. Cowan visited Stockholm. Among the many sessions was the important one on mine lighting, at which a paper on the problems associated with underground lighting and one dealing with miner's nystagmus were discussed. It was clear from the discussion that coal face lighting is possibly the most difficult of all lighting problems. It is not always realized that the reflection ratio of the average working face is about three per cent and that nearly 97 per cent of the light falling upon it is absorbed and only the remaining 3 per cent of this light is reflected to the observer's eye.

British Standards Nos. 229 and 1259, and the Ministry of Fuel and Power Testing Memoranda Nos. 4 and 10, have been prepared as a guide to manufacturers and others concerned with the preparation of applications and with the procedure for flameproof and intrinsic safety testing. Despite such guidance applications are frequently received with the minimum of information and with poor, incomplete, and badly made drawings.

With regard to the use of certified flameproof apparatus, it is necessary to repeat that any alteration in the certified design, unless it has been approved specifically as provided for in the testing memorandum, will invalidate the certificate. Reports also show that alterations are being made to circuits which have been certified by the Ministry as intrinsically safe, without application being made to have the proposed modification covered by the Ministry's certificate. It should be made clear that any such alteration may result in danger and in any case will invalidate the certificate granted by the Ministry. The total number of electric motors in use for all purposes at mines under the Coal Mines Act at 30th June, 1951, was 97,183 representing 3,184,630 h.p. The figures for 1950 were 3,070,625 h.p. and 92,499 motors.

There were three fatal accidents during the year and all occurred underground. One involved an apprentice electrician who had been left, without supervision, at a gate-end box. A deputy received a shock from a damaged plug when attempting to insert it into the socket of a conveyor starter. The third accident involved a conveyor erector in a very wet supply gate when he apparently attempted to clean out the live cable plug which he had been carrying. In addition, nine men died as the result of an explosion of firedamp at Eppleton Colliery and the ignition was attributed to open sparking from a defective starter socket assembly on a joy loader. In another fatal accident the flexible cable of a face worker's cap lamp was caught by the unguarded conveyor motor chain sprocket of a face chain conveyor.

There were 65 non-fatal electrical accidents, resulting in injury to 71 persons. Of these accidents, 24 occurred on the surface and 41 underground. In addition, there were 17 dangerous occurrences. Of the 71 persons involved, 33 were electricians, including five apprentices, an increase of two over the year 1950.

DOMESTIC HEATING

By A. C. HAZEL*

The Place of Electricity and Other Forms of Fuel

THERE are various schools of thought regarding the place of electricity, gas and solid fuel in domestic heating. I believe there is a place for all three, as well as for the paraffin stove and the " Calor " gas heater.

It is essential that one should be clear in one's mind about the difference between convection heating and radiation and the standards of comfort these two different forms of heating provide. The electric fire is undoubtedly the most common electric space heating appliance and this relies upon radiation.

Radiation and Convection

It is generally known that anything hotter than its surroundings also radiates heat to them in the form of heat rays and these rays travel like rays of light in straight lines. These heat rays do not, or at any rate to any appreciable extent, warm the air through which they pass, but only the objects they strike. They are not affected by draughts and they only affect the side exposed to them, and they can, in point of fact, cause heat shadows. For example, if one interposes an object such as a fire screen or high curb, it will cut off the direct radiation.

It should be remembered that most of the radiation in a room is eventually converted into convection as the walls, furniture and floor of the room are warmed. The higher the temperature of the heat source the more intense is the radiation from it. When the heat source becomes red hot, as in the case of an electric fire, the proportion of heat in the form of radiation (as compared with convection) is much greater than at lower temperatures. The intensity of radiation falls off rapidly as one moves away from the fire.

Convection occurs when air is warmed and rises as a result of being in contact with a hot surface. Cooler air takes its place, is subsequently warmed and rises, and thus a circulation around the room is set up. If one stands an electric fire in a fireplace, most of the convection is lost up the flue and this is equally true of a gas and even more so in the case of a solid fuel fire. In the case of hot water radiators or oil filled electric radiators, four-fifths of the heat is actually convection and one-fifth radiation.

Most people seem to like to bask in radiated heat because of the psychological stimulus of radiation on the body, but unquestionably convection provides more uniform warming than radiation and therefore the obvious answer as far as domestic heating is concerned is a combination of both radiation and convection.

Draughts and Room Ventilation

Before leaving this question of heat transfer, one must bear in mind another factor and that is draughts. Most homes in this country suffer from draughts and they cannot always be completely eliminated by weather stripping and draught-proofing. Furthermore, the draughts are intensified when high temperature heat source appliances are used, because the cold air rushes to the high temperature and rises rapidly. Thus one would only use a convector with a high temperature element if one wanted rapid air movement. In the average domestic dwelling air movement should be reduced to the minimum.

Whatever form of heating is employed, the home should be adequately insulated. The use of a layer of mineral wool to a depth of 2in between the rafters of the average home will cost about £6 to £8, and as one-third of the heat loss from a home is through the roof space, it can quite easily be seen that this investment will pay handsome dividends.

Weather stripping and draught-proofing are a little more expensive, but £8 to £10 spent on weather stripping the front and back doors is also well worth while and will also reduce the movement of air within the house. The other factors that must be considered in settling on the ideal method of domestic heating are the cost of installation and operation, safety, and atmospheric pollution.

It is generally agreed that the time has come when we must reduce atmospheric pollution to the absolute minimum in large centres of population. Anyone living in a large town to-day knows only too well the dirt and dust that covers everything if one opens the windows, and the appalling " smog " of 1952 brought home to everyone the seriousness of the matter. It therefore follows, at any rate in the large centres of population, that smokeless fuel must be used for domestic heating, be it solid fuel, gas, or electricity.

Safety

The question of safety is very often overlooked and yet Dr. Leonard Colebrook, in presenting his case for legislation aimed at reducing the suffering and the deaths through burning accidents in the home, has calculated that during the period 1945–49 well over 1,000 people lost their lives through contact with heating appliances and over 700 deaths from burning were recorded under the headings " By clothing or other causes " and " By other means."

It therefore follows that whatever the method of domestic heating it should be made as safe as possible, particularly where children and old people are concerned. A radiant appliance should never be left in a room unguarded or unattended.

In considering this question of safety one should also bear in mind that heating appliances should be so designed that even if a newspaper falls upon them there will be no risk of fire. Children have a nasty habit of playing with paper and pushing it through the holes of a wire guard. Wire guards should, therefore, be of narrow mesh, though it must be remembered that the introduction of a wire guard does, of course, reduce the efficiency of radiation from the fire.

With regard to cost, all sorts of figures are quoted regarding the efficiency of various appliances and their cost of operation. I do not propose to get involved in any arguments about cost but will merely make the point that solid fuel is invariably cheaper than gas and that gas is invariably cheaper than electricity, but I am a great believer in freedom of choice and so let the public have what they are prepared to pay for.

If one requires something to sit by for half an hour in the morning while having breakfast, then what could be better than the portable electric fire providing it is adequately guarded and will not set the morning paper on fire if it happens to drop on it. On the other hand, if one is fond of reading, watching television, or sitting

*Managing Director, Hurseal, Ltd.

at home on winter evenings and requires a comfortable room, what is better than a room centrally heated either by hot water or oil filled electric radiators topped up by a radiant solid fuel appliance. One must never forget the psychological factor of watching flickering flames, but again the public must have freedom of choice and if someone wants to sit by an electric fire, by all means let him do so. All that one must insist on is that the householder pays the true cost of producing the heat and not an artificial cost, and does not annoy his neighbour by polluting the atmosphere to an alarming extent.

Improved Open Fires

The Ridley Committee's report was a reasonable publication and most thinking men and women in the heating industry agree with its conclusions. To-day there is on the market a free standing open fire with convection and with a restricted throat of the type recommended by the Ridley Committee. It sells at under £10. It has a high overall efficiency, eliminates excessive room ventilation, and provides for safe continuous burning. Quite apart from the question of efficiency, the householder has something nice to look at, and householders in this country like the open fire, and it will take us a long time to wean them away from it.

These new type solid fuel appliances are, of course, continuous burning and can be turned up or down like a gas fire as they have both air inlet and flue damper controls. However, open fires produce ash, and the ash pan has to be emptied once a day. Furthermore the fire has to be refuelled three or four times a day. Nevertheless people prefer to do this and it is possible to get continuous heating in an average sized room with a fuel consumption of as low as 16 lb in 24 hours, or $\frac{3}{4}$ cwt a week. To do the same job with electricity would cost about $2\frac{1}{2}$ to 3 times as much. If the room is a large one, then the obvious answer is to use an oil filled electric radiator at the other end of the room, so as to provide convection heating and thus keep a movement of warm air throughout the room without creating draughts.

By leaving the main winter space heating load to solid fuel, the electricity supply industry is avoiding having any unfortunate peaks and there can be nothing better than electricity for providing the increased amount of convection to get completely comfortable conditions. In the case of the larger home, there is nothing cheaper, as far as operating costs are concerned, than a solid fuel boiler of about 45,000 B.Th.U. output with three or four radiators to take the chill off the home, but a solid fuel boiler again means a certain amount of labour.

If a householder wants to avoid having the bother of refuelling the boiler and emptying the ash, then why not have complete central heating with some form of low surface temperature electric heating appliance under separate air thermostat control? There can be nothing better from the comfort point of view, but of course it is expensive to operate.

Partial Central Heating

The ideal combination is partial central heating by hot water in the case of the larger domestic dwelling, leaving the bedrooms and rooms not regularly occupied to be heated by electric central heating radiators under both thermostatic and time switch control. Bedroom electric central heating radiators would come on at 7 p.m. with the object of getting the bedrooms comfortably warm and they would be automatically switched off at 11 p.m. because most people like to sleep with their windows open and there is no point in heating the outside air.

It can be argued that one can stand in front of an electric fire while undressing but it is a question of what standard of comfort you require. If one wishes hurriedly to undress in the rays of an electric fire and then jump into a cold bed with just one's nose peeping above the blankets until one is warm and can then sit up and read, all well and good, but if one wishes real comfort and is prepared to pay for it, why not do the job properly?

One of the troubles about this country is that we do not know the value of real warmth and comfort. We tend to sit and shiver and yet we would think nothing of spending the cost of heating a room for a whole week on a couple of drinks or a couple of packets of cigarettes.

Dr. Harold Hartley, in his Melchett Lecture at the Institute of Fuel, pointed out that in 1952 the national expenditure on beer amounted to £563 million, tobacco £821 million, and on fuel and light £438 million. This last amount is equivalent to an average household outlay of approximately £30 per annum or about equal to the cost of ten cigarettes a day for each household.

The annual capital expenditure on new appliances is also relatively small and averages about £4 10s 0d per household, or in the alternative currency, less than ten cigarettes a week. Furthermore, as Dr. Harold Hartley reminds us, of the £438 million spent annually on fuel as much as £260 million worth may well be wasted.

Instead of quarrelling with each other as to which is best for the householder: gas, electricity or solid fuel, we should all educate the householder to appreciate the value of heat comfort and make people work for it.

One appreciates that we are short of coal but everyone is entitled to a higher standard of life and this means more warmth in the home and what we must endeavour to do is to use the coal efficiently, but we must stop telling the public that they must not do this and they must not do that. We have a duty to the miners to avoid waste but beyond that we should be allowed to use as much fuel as we wish for our own creature comforts.

Fire Recess

One of the simplest ways of giving householders a greater freedom of choice in the type of fuel they wish to use for heating their main living room would be to provide, instead of the existing fireplace, a recess into which one could stand an electric or gas fire or a free standing solid fuel stove or free standing open fire. Whichever appliance is stood in the recess will automatically operate at a greater efficiency because the fire will be providing a certain amount of convection. Furthermore there will be a restricted throat to the flue and it would be a simple matter to close the chimney. One can visualize the time coming when in the summer the free standing open fire will be lifted out and an electric or gas fire installed for use during the odd chilly evenings. All that is required are appliances which are portable, easy to lift in and out, and are tenant's property and not landlord's fixtures.

A fireplace recess will be much cheaper than the normal fireplace and can be made most attractive. In a small modern home a free standing open fire placed in a recess can be easily removed and replaced by an electric fire during the summer. Incidentally, the use of a fire recess instead of an ordinary fire surround opens up a new field of home decoration. The cavity can be coloured to harmonize as required. It could even be illuminated by strip lighting.

Though the electricity supply industry fully appreciates the value of the electric fire as a revenue earner, it is doubtful whether it fully appreciates the place that electricity could play as a means of background heating, leaving solid fuel and gas to play the part of topping up. At the present time it is safe to say that solid fuel and gas

do the background heating and electricity is used for topping up. As this topping up is usually during very cold spells, it follows that much of it may well be on the peak, in spite of all the guesses and arguments to the contrary.

If a room is maintained with the chill off during the day by means of a low surface temperature electric central heating unit providing convection, a householder could then light his open fire in the evening, or alternatively he may well decide to keep his open fire banked up during the day as well as maintaining the electric convection heater. Alternatively if he has a free standing stove or open fire which also provides convection, he could keep this banked up during the day and merely open it up at night when he requires radiation. In other words, when a room is not occupied, there is no point in providing radiation. All that one requires is convection to keep the chill off the room, bringing into play radiation when the room is occupied.

Special Tariff

One of the simplest ways of encouraging the use of convection as a means of continuous background heating would be to introduce "time of day" or "off peak" tariffs and load control. Householders would be asked to rent equipment which would control the whole of their power supply and electricity supplied off peak would be available at a special rate, the supply authority reserving the right to cut off the power circuit for any period it found necessary, though it would obviously be seldom more than an hour. Alternatively there would be a time clock meter, and electricity used during certain periods would be charged for at a higher rate. Housewives would have to wait to use their vacuum cleaners but it is doubtful whether this would worry them very much, or alternatively they would have to use them from the light circuit. The fact that their water heaters were switched off for an hour would not affect them in the slightest and if they used fluid filled electric central heating safety radiators they would not be inconvenienced because these have a thermal carry over of anything up to an hour.

There is a very considerable market waiting to be tapped which provides the perfect load factor for the supply authority and all that is required is for some enterprising Electricity Board chairman to try out the experiment in a town.

It should be remembered that while the diversity factor of electric fires is good, their load factor is poor and surely what the electricity supply authority requires more than anything else is a good load factor. The time has come to stop thinking about electricity as a means of occasional heating only—it can play a more useful part.

NEW BOOKS

Electrical Contractor's Annual, 1954. Edited by J. Rosslyn-Stuart. Pp. 358; illus. E. & F. N. Spon, Ltd., 22, Henrietta Street, London, W.C.2. Price 18s.

A useful section in the second edition of this book is an illustrated review of main panel design for small electrical installations, with examples of good and bad lay-out. With the present interest in rural electrification the wiring of farm buildings is also well chosen as the subject of another new chapter. Other contributions introduced deal with lift and hoist maintenance, television servicing and earth leakage trips. Within the limits of the space available these articles, with others on estimating and costing, lighting in shops and stores, electric lamp developments and new equipment and accessories, make readily available much information frequently required by contractors. The miscellaneous section containing tabulated technical data and the trade names and addresses have been brought up to date.—H.W.

Power and Process Steam Plant. Edited by E. Molloy. Pp. 184; illus. 110 and index. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 17s 6d.

A large amount of practical technical information is brought together in this book on a subject which has become prominent of late years in view of the possibilities of saving fuel by combining the provision of process steam and factory heating with the generation of electricity. Elementary thermodynamic principles are given. Up-to-date particulars of turbines, engines and boilers and of their operation and maintenance have been supplied by manufacturers of back-pressure and pass-out steam plant and the fields and limitations of each are outlined together with reference to cases in which *prima facie* a supply of electricity from an outside source is indicated.

Parallel running with the public supply is discussed, but according to Mr. D. B. Irving's C.I.G.R.E. paper in May the scope for this is limited. More than half of the 1,000 private plants in the London area are under 50 kW each and only 37 are over 500 kW; of the total twelve have switching facilities which permit of operation in parallel and two have capacity in excess of the owners' needs. A possible future development, not mentioned here, is the purchase of both power and process steam from nearby public supply stations operating with high steam conditions. Useful as this book will be as a general guide to works engineers, each case needs to be considered individually on its own economic merits.—C.O.B.

The Hammer and the Anvil: A Background to Michael Faraday. By James F. Riley. Pp. 40 (illus.). The Dalesman Publishing Co., Clapham, via Lancaster. Price 4s 6d.

From childhood Dr. Riley had been impressed by Faraday's genius and gift of simple exposition and had visited Clapham where Faraday's father lived and worked. He set out some years ago to discover all he could about Faraday's parents and about the Sandemanian religious sect of which they and their distinguished son were members. This little book, the result of Dr. Riley's researches, explains and illuminates the religious strain in Faraday's character and is an interesting addition to Faradian literature.—J.H.C.

Books Received

The Physics of Experimental Method. By H. J. J. Braddock. Pp. 404; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 35s.

Electronics. By A. T. Starr. Pp. 395; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 32s 6d.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 21st July from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

1324. Ericsson Telephones, Ltd., and Acton, J. R.—Electronic counting arrangements. 13th January, 1950. (712171.)

30523. Electron discharge devices for use in electronic counting and/or selecting arrangements. 29th November, 1950. (712174.)

6985. National Research Development Corporation.—Electronic circuits for multiplying binary numbers. 13th March, 1950. Cognate application 10527, 20th April, 1949. (712172.)

1950

2326. Ericsson Telephones, Ltd., and Burnett, L. C.—Electronic counting and/or registering arrangements. 30th January, 1951. (712175.)

6928. Claesson, P. H. E.—Communication systems. 20th March, 1950. (712176.)

15584. Ericsson Telephones, Ltd., and Acton, J. R.—Electronic counting and/or selecting arrangements. 20th June, 1951. (712177.)

23585. General Electric Co., Ltd., and Curtis, T. J.—Methods of forming insulating coatings on elongated members and articles formed by such methods. 26th September, 1951. (712313.)

24703. Senne, E. P.—Vacuum cleaners. 10th October, 1950. (712233.)

1951

4260. Sylvania Electric Products, Inc.—Cold-cathode discharge tube. 21st February, 1951. (712101.)

5496. Cole, Ltd., E.K., and Burnard, C. L.—Negative feedback and tone in audio frequency amplifiers. 6th March, 1952. (712183.)

7395. Chromatic Television Laboratories, Inc.—Cathode-ray tubes for colour television. 30th March, 1951. (712237.)

8319. General Electric Co., Ltd., and Williams, C. E.—Circuit arrangements for operating low-pressure electric-discharge lamps. 14th May, 1952. (712239.)

10624. Midland Electric Manufacturing Co., Ltd.—Electric switch contacts. 28th April, 1952. (712403.)

11152. British Thomson-Houston Co., Ltd.—Translucent coatings. 11th March, 1952. (712185.)

15409. General Electric Co., Ltd., Emms, S. A. G., and Pelton, B. S.—Tachometer devices and control systems including such devices. 13th June, 1952. (712412.)

16274. English Electric Valve Co., Ltd.—Hydrogen filled electric-discharge tubes. 24th April, 1952. (712111.)

16881. Morgan Crucible Co., Ltd.—Brushes for dynamo-electric machines. 10th July, 1952. (712188.)

18867. English Electric Co., Ltd.—Control systems for dynamo-electric machines operatively coupled to coilers or the like. 10th November, 1952. (712189.)

20396. British Thomson-Houston Co., Ltd.—Means for reducing low frequency modulation in high frequency alternators. 26th June, 1952. (712252.)

21025. British Messier, Ltd.—Electromagnetic devices for controlling fluid-pressure circuits. 26th August, 1952. (712329.)

21488. Elmeg Elektro-Mechanik Ges.—Electromagnetic impact tools. 12th September, 1951. (712334.)

21591. Brookhirst Switchgear, Ltd., and Butterworth, E. M.—Electric plug and socket connectors and electric switchgear, contactors, motor control gear and other electrical apparatus embodying such connectors. 26th August, 1952. (712417.)

22305. Lucas (Industries), Ltd., J.—Retractive electric switches. 23rd September, 1952. (712122.)

22357. Electric & Musical Industries, Ltd.—Cathode-ray tubes and arrangements therefor. 17th September, 1952. (712254.)

22620. Postmaster General.—Electrical transformers or inductors. 18th November, 1952. (712124.)

23865. Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares-Etablissements Claude Paz & Silva.—Lighting system comprising discharge lamps. 12th October, 1951. (712126.)

27645. Heinrich, D. O.—Static collecting zones of two-stage electrostatic precipitators. 26th November, 1951. (712199.)

27652. Cathodeon, Ltd.—Generator for television and like waveforms. 26th November, 1952. (712432.)

27837. Soc. Alsacienne de Constructions Mecaniques.—Pressurized telecommunication cables. 27th November, 1951. (712260.)

29045. Dittgen, J. K., and Carl, H.—Electrically heated apparatus for use in the baking of foodstuff. 8th December, 1952. (712435.)

29106. British Thomson-Houston Co., Ltd.—Gas-blast electric circuit breakers with resistance switching. 12th December, 1951. Addition to 666834. (712436.)

29180. Licentia Patent-Verwaltungs-Ges.—Dry-plate rectifiers. 13th December, 1951. (712262.)

1952

922. British Thomson-Houston Co., Ltd.—Position control servo systems for lifts and the like. 12th January, 1953. (712206.)

3148. British Thomson-Houston Co., Ltd.—Clothes drying machines. 6th February, 1952. (712138.) 3966. 14th February, 1952. (712140.) 8131. 31st March, 1952. (712144.)

3945. Murex, Ltd.—Electrical switching apparatus for use in liquids, or in inflammable or explosive atmospheres. 16th February, 1953. (712347.)

4531. Marconi's Wireless Telegraph Co., Ltd.—Frequency modulated carrier wave transmitters. 6th November, 1952. (712349.)

4601. Hackbridge & Hewittic Electric Co., Ltd., and Wells, R.—Overcompounded mercury arc rectifiers. 17th November, 1952. (712267.)

5370. Standard Telephones & Cables, Ltd.—Circuit arrangement for the generation of a control voltage for the automatic amplification control of television receivers. 29th February, 1952. (712292.)

9798. English Electric Co., Ltd.—Inductor alternators. 17th April, 1953. (712362.)

11150. English Electric Co., Ltd.—Dual fuel internal-combustion engines. 1st May, 1953. (712365.)

11443. Ultra Electric, Ltd.—Vibrating reed interrupters and applications thereof. 6th March, 1953. (712298.)

11586. Schweizerische Isola-Werke.—Extrusion process and a machine for the production of an insulating covering on an electrical conductor. 7th May, 1952. (712367.)

11784. English Electric Co., Ltd.—Electrically propelled vehicles. 8th May, 1953. (712368.)

12715. Westinghouse Electric International Co.—Luminescent materials. 20th May, 1952. (712301.)

15603. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 7th May, 1953 (712372.)

15618. English Electric Co., Ltd.—Electric cooking apparatus. 19th June, 1953. (712462.)

16136. Bendix Aviation Corporation.—Discharge tube for d.c. voltage regulation. 26th June, 1952. (712273.)

17552. General Electric Co.—Automatic electric toasters. 11th July, 1952. (712375.)

17563. Standard Telephones & Cables, Ltd.—Microwave filters. 11th July, 1952. (712306.)

18409. Compagnie Générale de Télegraphie sans Fil.—Frequency modulated wave apparatus. 21st July, 1952. (712308.)

21468. General Electric Co.—Electric control circuits. 26th August, 1952. (712217.)

22547. Landis & Gyr Akt.-Ges.—Cam-operated electric switch. 8th September, 1952. (712156.)

23969. Philips Electrical Industries, Ltd.—Superheterodyne receivers incorporating automatic frequency-stabilizing means. 24th September, 1952. (712281.) 23973. Image-intensifying tubes. 24th September, 1952. (712282.) 24701. Tunable oscillators with automatic frequency stabilization. 2nd October, 1952. (712283.)

25146. Hoover, Ltd.—Dynamo-electric machines. 7th October, 1952. (712465.)

25414. Vossloh-Werke Ges.—Quadruple electric socket outlet. 10th October, 1952. (712222.)

26288. General Electric Co.—Luminescent screens. 20th October, 1952. (712286.)

29479. Standard Telephones & Cables, Ltd.—Method of coating a plurality of electric impedance elements, such as condensers, and an impedance element coated in accordance with that method. 21st November, 1952. (712289.)

30381. General Electric Co.—Temperature and arc resistant insulating materials. 1st December, 1952. (712228.)

31231. General Motors Corporation.—Household refrigerator. 10th December, 1952. (712165.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 26th June:—

No. B725,745 (design). Class 9. Electrical and acoustic apparatus and instruments; sound recording and sound reproducing instruments and apparatus; electric batteries and electric accumulators, etc., and parts.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

HALTRON (design). No. 726,335. Class 9. Radio valves.—Hall Electric Ltd., Haltron House, 49–55, Lisson Grove, London, N.W.1.

SPEC. No. 726,495. Class 9. Electrical apparatus and instruments.—Philip Woolfson, Ltd., 33, Cadogan Street, Glasgow, C.1; also trading as Scottish Precision Engineering Co., 27, Cadogan Street, Glasgow, C.2.

HEC. No. 727,663. Class 9. Electronic computors.—British Tabulating Machine Co., Ltd., 17, Park Lane, London, W.1.

LADY MARGARET. No. 728,741. REGATTA. No. 728,742. Class 9. Radio, television and telegraphic instruments and apparatus; electric batteries; and cases of electric torches or electric pocket lamps, etc.—Vidor, Ltd., West Street, Erith, Kent.

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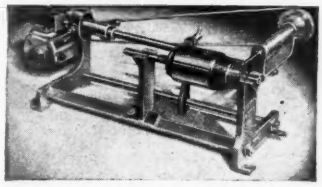

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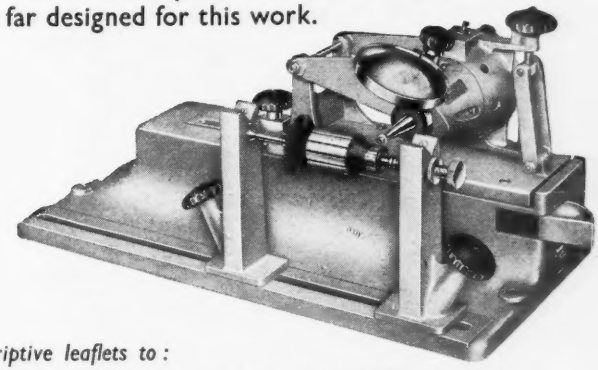

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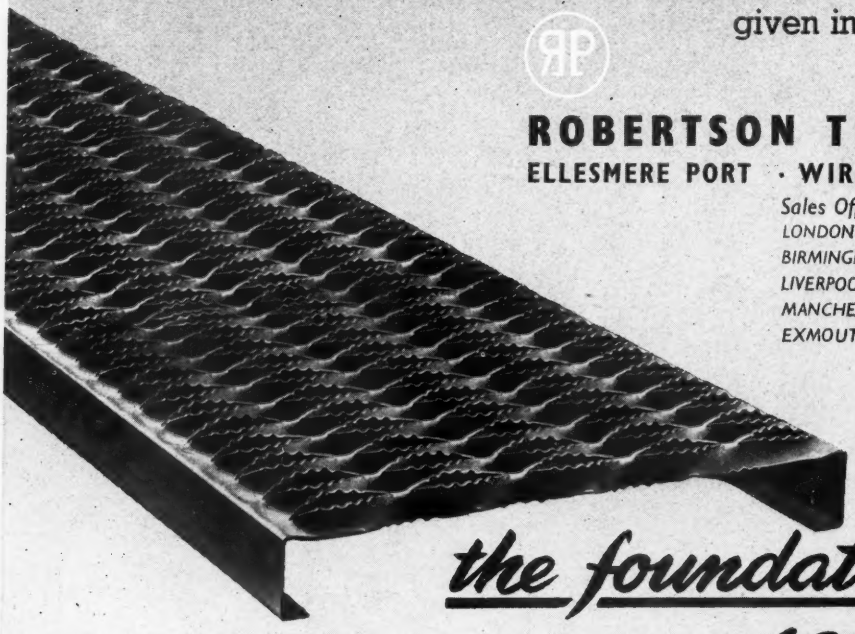

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Financial Section

STOCKS and SHARES

IN the gilt-edged market, prices have been given a fresh lift by the terms of the Treasury's latest borrowing operation. In conjunction with the earlier reduction of Bank Rate, it was read as a further sign of confidence in the prospects for Government securities. The industrial markets have been unable to make much further headway against the influence of the Whitsun holiday and the other distractions of this season. Activity contracted, but prices held generally firm and were as ready as ever to respond in individual cases to good company news.

Price Changes

The improvement in the gilt-edged market led to rises of up to 10s per cent in the British Electricity Authority issues. Among industrials, Vickers were notably firm at 64s 6d following news of the aircraft orders from America. British Electric Traction 5s deferred have been outstanding in rising to 49s 6d in advance of the final dividend declaration: last year, the company paid a total of 35 per cent, and raised the interim payment for the latest period from 10 to 15 per cent. Siemens remained dull at 35s, but Lancashire Dynamos went further ahead to 57s 6d, which compares with 50s 9d only a month ago. Scottish Cables retained the sharp rise to 17s induced by the increase in the dividend from 20 to 27½ per cent. Other firm features include Brook Motors at 38s, Electric Constructions at 61s 6d, E.M.I. at 14s 6d and Tube Investments at 69s 6d.

Doubled Distribution

In respect of the year ended last March, the Engineering & Lighting Equipment Co. announces a doubling of the net profit and of the ordinary distribution. Already a good market in anticipation of good results, the 2s shares subsequently rose further from 6s to 7s 6d. They stood at less than half that price a few months ago, and have been under 1s at times since the war. Trading profits, which have been rising consistently for a number of years, are reported this time to have expanded by the best part of £100,000. Tax charges are correspondingly swollen, but the net surplus of £85,000 is, as mentioned above, just about twice the previous figure. The raising of the ordinary payment from 15 to 30 per cent (including 10 per cent as bonus) is the fourth increase in succession, and involves the distribution of only one-fifth of the amount available. It produces a yield of 8 per cent on the shares at their enhanced price.

New Issues

Plessey ordinary stock is quoted now in 10s units, as a result of the 100 per cent scrip bonus, and is also ex-rights to the offer of new shares at 30s. In their new form, the shares have improved again upon previous outstanding performances, rising during the past week to a fresh peak of 49s 6d. The new shares stand at a premium of 20s; they do not qualify for the 10 per cent interim dividend declared last month. Bonus shares issued this year by S. Smith & Son participate in that company's interim recently announced: in raising the rate to 5 per cent, the company advised stockholders that this should not be taken to indicate a larger total for the year. There has been a further advance in the price of the shares to 11s since the announcement.

Radio Rentals

As in the case of Plessey mentioned above, a bonus issue appears to have stimulated fresh interest in the similarly dynamic 5s shares of Radio Rentals, Ltd. These shares have responded very positively, over the past year or so, to the remarkable growth of the business and the concurrent improvement in dividends. They stand now at 41s 6d ex-bonus, with the new shares about 6d higher. The last distribution of 40 per cent would have been equivalent to about 26½ per cent on the ordinary capital of £374,000, as increased by the one-for-two bonus. A market publication estimates that the profits of 1952–53 represent earnings of 170 per cent on the present capital, allowing for the bonus and other changes, and also for the elimination of the excess profits levy. This cost the company over £100,000 last time, or roughly twice the amount of the net dividend distributions.

Vactric Dividend

The Vactric company's reported trading profit of £364,000 for the year ended last March, compares with a loss of £33,000 in the previous twelvemonth, and brings the shares back into the dividend list for the first time since 1945. The declaration of a 10 per cent payment on the £150,000 ordinary capital follows earlier news of the repayment of the company's debt to the Treasury, and the clearance of preference dividend arrears up to date. Having been the subject of speculative attention at times in recent years, the shares have fluctuated in price between extremes of 3s and over 20s. Following publication of the latest results they were quoted on the basis of 16s.

Industrial "Averages"

Comment on this year's rise of many share prices to the highest levels ever registered involves references at times to the industrial market "averages," and a note on the latter may be of service to those who are not familiar with the term. One or two of the financial publications, and several of the statistical services, compile an index on the basis of a score or so of the most popular investments in a comprehensive range of industries, including, for instance, some of the leading shares in such markets as chemicals, electrical equipment, breweries, tobacco, stores, and so on. An average of all the prices is taken at the close of each day (or longer period) and translated into an index number. Changes in the latter give, consequently, a sensitive indication of the overall state of the industrial market. These are the "averages" which have lately broken through the previous all-time peaks recorded in 1947, at the height of the cheap money era.

Telephone Finance

Sir Alexander Roger's statement in the Anglo-Portuguese Telephone Co.'s annual report gives the background to the proposed capital issues. These are to consist of a public offer (with preferential consideration to applications from ordinary and debenture stockholders) of a million 6½ per cent preference shares, and an offer of 255,000 ordinary shares by way of "rights" to existing holders. Over a great many years, finance has generally been provided in the first instance by the Telephone & General Trust in the form of loans, which have been repaid in due course from the proceeds of capital issues. On this occasion, the Telephone Co. will be raising substantially more than the amount required to repay the £832,000 now on loan from the Trust, and hopes in future to make similar "rights" issues as the occasion arises. The chairman reviews the busiest year in the company's history, and a prospect of further active expansion.

Because of the Whitsun holiday our usual investments table is omitted this week.

NEW COMPANIES

W. G. Wigginton, Ltd.—Registered 21st May. Capital £1,000. Electrical engineers and contractors, manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: W. G. J. Wigginton, W. H. G. Wigginton and Dorothy K. M. Wigginton. Regd. office: 387, North Circular Road, Neasden, N.W.10.

P. R. Holmes (Electrical Contractors), Ltd.—Registered 21st May. Capital £100. Directors: P. R. Holmes, Florence Holmes, G. A. Holmes and Joan Holmes. Regd. office: 21, Crown Passage, Pall Mall, S.W.1.

Leake Brothers, Ltd.—Registered 21st May. Capital £1,000. Electrical engineers and contractors, etc. Directors: K. G. Leake and Frances M. Leake. Regd. office: 8, Hereford Gardens, Pinner, Middlesex.

REPORTS and DIVIDENDS

W. T. Henley's Telegraph Works Co., Ltd.—The annual meeting was held on 4th June, Sir John Dalton (chairman) presiding. In presenting the report and accounts Sir John said that 1953 proved to be a difficult year for the cable-making industry; there was a fall in the prices of the main materials and a reduction in the value of the considerable stocks of wires and cables which must be held. Nevertheless the company was able to maintain about the same margin of trading profit as in 1952 on a somewhat smaller turnover.

Dealing with the subsidiaries, the chairman said that Henley's Tyre & Rubber Co., Ltd., made a substantial recovery in 1953, although it was not yet back to the dividend-earning stage. The business of Henley's (South Africa) Telegraph Works Co., Ltd., was well maintained, but profits on the general business were rather lower owing to existing conditions in South Africa. The business of the Contract Department in South Africa continued satisfactorily. Oakley Brothers, Ltd., experienced a difficult year, but during the latter part there was a substantial recovery in business and this had continued in 1954.

Turning to conditions at home, Sir John said the nationalized industries continued to live on their large stocks of cable and only recently had there been signs of an improvement in their demands. Cable buyers held up orders in the expectation of a fall in price following the release from control of copper, and the new British Standard for rubber and thermoplastic cables, permitting reduced thicknesses of insulation and sheathing and thus lower prices, induced buyers to live on their stocks and await developments. To improve the position in the home market new premises had been acquired in Glasgow and Edinburgh and a new building was planned at Bristol. The range of manufacture had been extended so as to offer more comprehensive designs of high voltage cables and accessories as well as an improved type of low voltage cable, a fully impregnated non-draining cable which was being marketed under the name of "F.I.N.D." They were also manufacturing and marketing aluminium sheathed cables. In other directions, including distribution equipment, new lines had been developed. The sales position in overseas markets had been improved and during 1953 the overseas business amounted to 33⅓ per cent of the turnover, an increase on the previous year.

Referring to some of the more important contracts received, Sir John said that several of large value were placed by the Belfast Corporation for e.h.v. and l.v. cable, and in course of production was a three-core 110 kV oil-filled cable for that authority, the first to be manufactured in this country. Contracts were received from the B.E.A. and the Area Electricity Boards, Government Departments and from other nationalized industries. Abroad, they completed orders for the Delhi power station and had two major overhead line contracts for the Madras State and for East Pakistan. They had recently obtained the contract for the cable required for the land link in the Atlantic telephone scheme. Henley's would supply the land line across Newfoundland linking the submarine cables between Great Britain and Newfoundland and Newfoundland and Nova Scotia. Orders had been received from American interests, and for the supply of telephone cables to the Telephone Co. of Bogota to the value of one million American dollars.

In considering the prospects of the company for the current year, attention should be drawn to the fact that the outstanding order book at the beginning of the year was less than at the beginning of 1953, although the indications were that the intake of orders this year would be somewhat better than last year. With regard to the factory now being completed in Australia in association with certain other cable manufacturers, in spite of delays it was hoped that the factory would be in operation in the present year.

Enfield Cables, Ltd.—The annual meeting will be held on 22nd June. In his circulated statement Sir Philip Warter (chairman) says that the trading profit for 1953 of £101,286 is arrived at after providing for a trading loss of £238,985 incurred by Brynmawr Rubber, Ltd., and after charging expenditure of £68,773 on the wind power project. But for these two heavy charges the trading profit for the year would have been over £400,000. A large part of the profit made by the cable works in 1953 was derived from business obtained in the previous year. After referring to the acquisition of Brynmawr Rubber, Ltd., by the Dunlop Rubber Co., Ltd., the chairman says that the 100 kW wind-driven generator developed for operation on the British Electricity Authority's system in North Wales is being moved this summer to its permanent site in Wales. The manufacture of the machine cannot be undertaken in the company's factories and in order that they may concentrate on the products for which they are equipped, the board have decided not to enter into the manufacture or sale of this type of equipment and their aim is—when the first machine is working properly in Wales—to find another enterprise able and willing to carry on and develop what they have started.

Trading conditions in 1953 have been difficult. Sales both in the home market and overseas were substantially lower than in 1952. In the home market the chief causes of the reduced demand are the drawing to an end of the period of post-war re-equipment and the restricted purchasing of Area Electricity Boards whilst their stocks are being reduced. In exports the world oil industry has become an important market and orders have been received for the supply of power cable to oilfields and oil refineries in Aden, Australia, British Borneo, Canada, and the Persian Gulf amongst others.

Siemens Bros. & Co., Ltd.—The report and accounts for 1953 show a consolidated profit, after all charges (except taxation), of £754,867, as compared with £1,431,346 for 1952, to which is added £112,993 income from investments, making £867,860. Income tax absorbs £379,503 (against £964,224), leaving a net profit of £448,357 (£556,425). A balance of £978,600 is brought in, and with £75,000 provision for taxation in previous years not now required, the balance available is £1,541,957. Of this reserves receive £409,162, and it is proposed to pay a dividend on the ordinary stock of 10 per cent (unchanged), leaving £878,420 to be carried forward.

In his statement which accompanies the report and accounts, General Sir William D. Morgan (chairman) says that the fall in trading profit is due to a variety of causes. Competition abroad became acute, with the result that an appreciable proportion of the export orders secured had to be taken at small profit, and in some cases executed at no profit at all. The severity of this competition, chiefly from Continental countries, is illustrated by the fact that orders were placed at prices much below those possible under production conditions in this country. Other adverse factors were the continued shortage of orders, mainly from nationalized undertakings, for power cables and accessories, and a serious increase in manufacturing and distribution costs due to wage and salary awards.

The principal home subsidiary, Siemens Electric Lamps & Supplies, Ltd., has also felt the impact of these difficulties. Sales of rubber-insulated wires not only suffered a drop in volume but prices fell during the year and were further affected by the introduction of a change in specification. Another factor was the increased cost of producing electric lamps, which was not counterbalanced by increased selling prices.

Of the overseas subsidiaries, the Canadian Co. has had a particularly difficult year, while in Australia, South Africa and India results were affected in varying degrees by national capital expenditure limitations, import restrictions and the increasing growth of local manufacture. Efforts are being made to strengthen the sale organization and in particular to expand overseas markets. The two main companies with whom they are associated, the Siemens & General Electrical Railway Signal Co., Ltd., and Submarine Cables, Ltd., prospered in 1953. The former has just completed a large contract for the supply and installation of the signalling equipment for the Toronto Subway, while the latter is playing a big part in the Atlantic telephone cable project.

Vactric, Ltd., reports a group profit for the year to 27th March last of £364,218, as compared with a loss of £32,615 for the preceding year, to which is added over-provisions, etc., of £28,314 (against £116,382). After providing for depreciation, interest, etc., of £60,476 and taxation of £186,253 (against a credit of £18,532), there is a net profit of £145,803 (against £23,586). It is proposed to pay an ordinary dividend for the year of 10 per cent, the first since 1945. The balance carried forward is £229,666 (against £128,735 brought in).

Broadcast Relay Service, Ltd.—The directors have decided to simplify the capital structure of the group by the liquidation of two subsidiary holding companies, Rediffusion Holdings and Rediffusion, Ltd. The announcement states that following the reacquisition of the minority interest in those companies formerly held by the British Electric Traction Co., they have fulfilled their main purpose. Before liquidation the names of the two subsidiary holding companies have been changed to C. H. Holdings (London) and Relay Holdings respectively.

J. Stone & Co. (Holdings), Ltd.—A group profit of £1,416,585 is reported for 1953, as compared with £1,280,567 for 1952, and after providing £868,470 for taxation, the net profit is £548,115 (against £495,108), to which is added £250,000 tax no longer required, and £116,281 E.P.T. refund. General reserve receives £570,608, and it is proposed to pay a final

dividend of 15 per cent, making 20 per cent for the year on the £600,400 ordinary and on the " A " ordinary as increased to £771,943 by the rights issue last March of £171,543. For the previous year the final dividend was 13 per cent, making 18 per cent for the year.

The directors propose to make a scrip issue to ordinary and " A " ordinary shareholders in the ratio of one for every two held. They state that the issue, for which Treasury consent has been obtained, carries with it no implication as to the future rate of dividend.

John Thompson, Ltd., in a preliminary statement, show a group trading profit for 1953 of £1,472,760, as compared with £1,343,729, and after meeting all charges, including £769,940 for taxation, the net balance is £413,168 (against £381,158). It is proposed to pay a final dividend of 12½ per cent, maintaining the distribution for the year at 22½ per cent.

Treasury consent has been obtained for the issue of 1,146,599 ordinary 5s shares at 15s each to be offered to ordinary shareholders in the proportion of one new share for every three held. The new shares do not rank for the final dividend now declared, but will participate in any interim for 1954.

Vent-Axia, Ltd.—The accounts for the year ended 31st March last, subject to audit, show a group profit, before taxation, of £115,317. This includes profit for eight months of a subsidiary acquired, and compares with £85,723 for the previous year. To the group profit is added £1,509 tax over-provided. General reserve receives £20,000 and taxation absorbs £65,893. It is proposed to pay a final dividend of 45 per cent (against 37½ per cent), making 70 per cent for the year (62½ per cent). The balance carried forward is £12,248 (against £14,474 brought in).

The Engineering & Lighting Equipment Co., Ltd.—The accounts for the year ended 31st March last show a net profit, after providing £136,500 for taxation, of £84,912, as compared with £41,285 for the previous year. It is proposed to pay a dividend for the year of 20 per cent (against 15 per cent), and in addition a bonus of 10 per cent (against nil).

R. A. Lister & Co., Ltd., have declared an interim dividend of 2½ per cent (unchanged).

Mather & Platt, Ltd., propose to issue 1,363,660 ordinary £1 shares in a two-for-three scrip issue.

S. Smith & Sons (England), Ltd., are paying an interim dividend of 5 per cent (against 2½ per cent). This is paid on increased capital and the rate has been increased so as to represent a higher proportion as interim.

Liquidations

T. & R.T.S., Ltd., electrical dealers.—Winding up voluntarily. Liquidator, Mr. B. Phillips, 76, New Cavendish Street, London, W.1, appointed 17th May. Particulars of claims to the liquidator by 25th June.

Russell Bros. (Ryde), Ltd., electrical and refrigeration engineers.—Winding up voluntarily. Liquidator, Mr. A. H. Cross, 30, High Street, Newport, I. of W., appointed 20th May. Particulars of claims to the liquidator by 14th June.

Bankruptcies

S. Whitton and **L. Whitton,** carrying on business in partnership at Church Place, Victoria Road, Leeds, 5, under the style of F. Whitton & Sons, electrical engineers.—Receiving order made 24th May on a creditor's petition. Public examination 20th July at the Court House, Albion Place, Leeds.

D. J. Hartshorne, 778, New Hey Road, Huddersfield, and Brook Royd Mills, Stainland, near Halifax, trading as Boyce, Weir & Co., electrical and mechanical engineers.—Receiving order made 24th May on debtor's own petition. First meeting 4th June at the Official Receiver's office, 20, North Parade, Bradford. Public examination 21st July at the County Court House, Queen Street, Huddersfield.

G. Frankis and **B. W. V. Smith,** lately carrying on business in co-partnership under the style of Brixham Electric Service at 4, The Strand, Brixham, and 9, Fox's Court, Union Lane, Brixham, Devon, electricians, radio and gramophone dealers.—First meeting 4th June at 12, Pennsylvania Road, Exeter. Public examination 16th July at the New Town Hall, Torquay.

R. B. Haill, lately carrying on business at 3, Lord Roberts Avenue, Leigh-on-Sea, electrical contractor.—Public examination 22nd July at 102, Alexandra Road, Southend-on-Sea.

Borrowing Powers Doubled

B.E.A.'s Vast Programme

PROPOSALS to increase the borrowing limits to £1,400 million for electricity and £450 million for gas are made in the Gas and Electricity (Borrowing Powers) Bill, which was presented in the House of Commons on 3rd June by Mr. Geoffrey Lloyd, Minister of Fuel and Power.

A memorandum on the Bill says that the existing statutory limits of £700 million for electricity and £250 million for gas are likely to be reached by the end of this year. Up to this month the borrowings sanctioned have been £635 million under the Electricity Act, 1947, and £230 million under the Gas Act. The revised limits are expected to suffice until 31st March, 1960.

The two industries have submitted comprehensive programmes covering likely developments up till 1960, this being about as far ahead as could be foreseen with reasonable accuracy. In the main the programme provides for a continuance of the general line of development which has been followed since nationalization. It covers expansion of production and distribution facilities to meet increasing consumer demands and includes extensive schemes of modernization of plant to ensure maximum efficiency and economy in operations.

The Minister has discussed the programmes with the industry and has given his approval to the general lines of development which they describe, subject to review from time to time in the light of changing circumstances.

Capital requirements for electricity from 1st April, 1953, to 31st March, 1960, include £742 million for generation, making with the actual expenditure since nationalization a total of £1,087 million; £152 million for main transmission, making a total of £192 million; £527 million for distribution, making a total of £801 million; and working capital £21 million, making a total of £41 million. The estimated total capital requirements up to 1960 amount to £2,121 million. The difference between that figure and the proposed limit of £1,400 million is largely to be met by financing from internal recources.

Capital requirements for gas up to 1960 total £579 million, of which £129 million will be financed from internal resources.

In connection with the proposed doubling of its borrowing powers the B.E.A. has produced a booklet entitled " Power and Prosperity," in which it sets out its achievements and future plans. The cover illustration shows the rapid rise of electricity output, which is expected to reach 90,000 million kWh a year by 1960. Reference is made to the coming severance of the South of Scotland from the Authority's system and it is roughly estimated that this will reduce the B.E.A.'s capital requirements up to 1960 by some £70 million, which the new Board will have to finance.

The history of the supply industry is briefly traced and the plant additions in recent years are shown. Something is said of thermal efficiency, maintenance, the grid, distribution, rural electrification, and research. A section, " Looking Ahead," follows in which future demands are estimated and plant programmes are dealt with. There are brief studies of the super-grid and the cross-Channel cable project.

A further section deals with the finances of the industry which leads to some notes on bulk supply and retail tariffs, and the final pages deal with the capital requirements up to 1960. It is planned to step up annual plant installation from 1,450 MW (sent out) this year to 1,950 MW in 1959 and thereafter.

There are eight useful appendices, including one showing generating plant under construction or planned. The brochure is handsomely produced and well illustrated. Copies (1s each) are obtainable from the B.E.A., at Winsley Street, London, W.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—14th July. State Electricity Commission of Queensland. Transformers for an 11 kV system for the Irrigation and Water Supply Commission. (E.S.B. 14085/54. Ten/9499.)* Distribution transformers for the Mackay City Council. (E.S.B. 14099/54. Ten/9496.)*

Belfast.—17th June. Education Department. Re-wiring of the lighting installation in Malone primary school, Balmoral Avenue. Education architect, 40, Academy Street.

Burma.—RANGOON.—20th June. Mineral Resources Development Corporation. Coal mining plant and machinery, electric generating sets and air compressors, safety lamps, etc. (E.S.B. 13899/54. Ten/9489.)*

Egypt.—CAIRO.—1st July. Cairo Electricity and Gas Administration. Underground h.v. cables. (E.S.B. 14083/54. Ten/9490.)*

London. — WANDSWORTH. — 16th June. Borough Council. Armoured cable. (See this issue.)

Londonderry.—Re-wiring and supply and fixing of lighting fittings at St. Eugene's Cathedral. Corr & M'Cormick, chartered architects, 7, Ferryquay Street.

17th June. Education Authority. Electrical installation at the Municipal Technical College. A. T. Marshall, architect, Princes Quay.

Merton and Morden.—28th June. U.D.C. Street lighting equipment. (See this issue.)

Netherlands. — THE HAGUE. — Directie Gebouwen, Werken & Terreinen. Work on airfields at Deelen, Eindhoven, Beek and De Peel, including lighting, diesel generators, transformers, cables, etc. (E.S.B. 13941/54. Ten/9467.)*

New Zealand. — WELLINGTON. — 7th July. Stores Division, G.P.O. Electrical measuring instruments. (E.S.B. 13654/54. Ten/9444.)*

Pakistan. — CHITTAGONG. — 29th June. Director of Supply and Development, Sadarghat. Tumbler switches. (E.S.B. 13973/54. Ten/9477.)*

KARACHI.—29th June. Posts and Telegraphs Department. Ringing machines for carrier repeater stations. (E.S.B. 14117/54. Ten/9493.)*

Portuguese East Africa. — LOURENCO MARQUES.—30th June. Ports, Railways and Transport Department. Electrical apparatus, including fuses, condensers, 6 V batteries, contacts, insulating materials, cable, resistances, commutator, electric lamps, etc. (E.S.B. 13986/54. Ten/9474.)* 10th August. Electrical material for the distribution line of the Beira Railway General Workshop. (E.S.B. 13987/54. Ten/9473.)*

Queensbury and Shelf. — 12th July. U.D.C. Street lighting equipment. (See this issue.)

South Africa. — JOHANNESBURG. — Stores Department, South African Railways. Switchgear. (E.S.B. 13958/54. Ten/9484.)*

Taunton.—30th July. Town Council. Seven vertical spindle pumps with six electric motors, one diesel engine, control gear, wiring, etc. A. H. S. Watern, engineer, 25, Temple Row, Birmingham, 2.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Felling-on-Tyne.—U.D.C. Sodium lamps in place of gas lighting in Sunderland Road (£5,622).—G.E.C.

Hertford. — Corporation. Rewiring 101 houses on the Bengeo estate (£2,309).—Eastern Electricity Board.

Leeds.—City Council. Electrical equipment at the Ambulance Station, Saxton Lane (£1,521).—Allenby & Stokell.

London.—L.C.C. Eighteen 8-person and four 4-person electric passenger lifts at Loughborough estate, Lambeth (£48,228).—Express Lift Co.

Newcastle-on-Tyne.—Education Committee. Electrical installations at the North Fawdon Primary School (£1,810), and in additions to the College of Industrial Design (£165).—A. S. Lowrey.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Birmingham.—Extensions to works at Masters Lane, Blackheath, for Tube Manipulations, Ltd.; A. J. Crump & Sons, Ltd., Aston Road, Dudley.

Blaydon (Co. Durham).—Garage at Winlaton for the Northern General Transport Co., Ltd.; R. C. Cowmeadow, architect, Churcham, Gloucester.

Bolton.—Extensions, Springfield Works, Sharples, for Wolstenholme Bronze Powders, Ltd.; John Dickinson, Ltd., Bolton.

Bristol.—Three-storey business premises on site in Queen's Road (£150,000); Maple & Co., Ltd., furnishers and decorators, 149, Tottenham Court Road, London, W.1.

Business premises in King Street; J. R. Phillips & Co., Ltd., wine and spirit merchants, 18/19, Nelson Street.

Cardigan.—Houses (100), Greenland Meadows estate; Howard Williams & Partners, architects, Priory Street.

Carlisle.—Additional storey to Marks & Spencer's stores in English Street; Norman Jones & Rigby, architects, Lord Street, Southport.

Chester-le-Street.—Additions to garage to accommodate another 97 buses for the Northern General Transport Co., Ltd.; Bewley & Scott, Ltd., builders, Dunston-on-Tyne.

Chesterfield.—College of Technology (estimated cost £110,000); county architect, Derby.

Corby.—Development of site in town centre; Boots Pure Drug Co., Ltd., Station Road, Nottingham.

Coventry.—Civic theatre with shops and flats, Corporation Street; city architect.

Ten shops and seven maisonnettes, Bell Green; C. F. Redgrave & Partners, architects, 6, Quadrant, Warwick Row.

Business premises in Templar and Torrington Avenues; Rider Betts & Sons, Ltd., corn merchants, 57/58, West Orchard.

Croydon.—Factory extension; Nuleaf, Ltd., Rosecourt Road.

Cumberland.—Area administrative offices at Flatt Walk, Whitehaven, for the C.C. (£50,000); county architect, Portland Square, Carlisle.

Derby.—Large extensions at Aston Hall Hospital, near Derby; W. J. Simms, Sons & Cooke, Ltd., Haydn Road, Sherwood, near Nottingham.

Derbyshire.—Additional laboratories in grammar schools (£55,000); county architect, Derby.

Eastbourne.—Factory, Brampton Road Trading Estate; Smith & Ouzman, Ltd., 123, Whitecross Street, London, E.C.1.

Gateshead.—Office building for the Armstrong Cork Co., Team Valley; Cordingley & McIntyre, architects, The College, Durham.

Ten-storey block of maisonnettes; borough architect.

Factory addition for the Anglo-Scottish Tool Co.; J. G. Cowe & Son, architects, Central Chambers, Chester-le-Street.

Greenhithe.—New depot, wharves, houses, etc., High Street and Mounts Road; F. T. Everard & Son, Ltd., shipowners, etc., 6, Fenchurch Buildings, London, E.C.3.

Halifax.—Flats at Mixenden and Illingworth sites; Marshall & Rushworth, Ltd., Huddersfield Road, Ellanp.

Hull.—Works extensions; Wm. Marsden & Co., Ltd., Londesborough Street.

London.—BRIXTON.—82 flats; Church Army Housing, Ltd., 55, Bryanston Street, W.1.

HOLLOWAY.—Rebuilding stores; W. Jelks & Sons, Ltd., 263/275, Holloway Road, N.7.

LAMBETH.—Dwellings (146), Caldwell Street; borough engineer.

MAYFAIR.—Offices, showrooms and warehouse, Great Marlborough Street; Vyse, Sons & Co., Ltd., 19, Poland Street, W.1.

Luton.—Rebuilding part of factory; Lye & Sons, Ltd., hat materials, New Bedford Road.

Manchester.—Rebuilding Rivoli Cinema, Barlow Moor Road, Chorlton-cum-Hardy; Wm. Thorpe & Sons, Ltd., Chester Road, Trafford Park, Manchester.

Extensions at Stretford Road for S. Smith & Sons (England), Ltd.; T. P. Bennett & Sons, architects, 43, Bloomsbury Square, London, W.C.1.

Twenty-three shops, with flats and maisonnettes over, Wythenshawe; Donald Hamilton, Wakeford & Partners, architects, 7, Connaught Place, London, W.2.

Margate.—Factory, industrial estate; Algraphy, Ltd., Willowbrooke Grove, London, S.E.5.

Nottingham.—Factory for Wolsey, Ltd. Kimberley; Cecil Howitt & Partners, architects, St. Andrew's House, Nottingham.

St. Helens.—Factory for North Western Industrial Estates, Ltd.; Sir Alexander Gibb & Partners, architects, Queen Anne's Lodge, London, S.W.1.

Salford.—Rebuilding bottling works; Groves & Whitnall, Ltd., brewers, Deansgate, Manchester.

New housing schemes at Southgart (Pendleton) and Eccles Old Road; W. Thorpe & H. Hirst Smith, architects, Barton Arcade, Deansgate, Manchester.

Stretford.—Extensions to works, Newton Street, for Capsules, Ltd.; Wm. Thorpe & Sons, Ltd., Chester Road, Manchester, 16.

Sunderland.—Additions, High Street West, for J. Clark, Ltd.; W. & T. R. Milburn, architects, 17, Fawcett Street.

Surrey.—Power house, workshop and offices, and pumping station, Hogsmill Valley; for Joint Sewerage Board; John Taylor & Sons, engineers to the Board, Artillery Row, Victoria Street, Westminster, S.W.1.

Wakefield.—Factory, George Street; Close Asbestos & Rubber Co., Ltd., 5a, Cheapside.

West Bromwich.—Works, Whitehall Road; Hot Pressed Products, Ltd., Aston Hall Road, Birmingham.

West Ham.—Factory, Shirley Street; G. Pidduck & Co., Ltd., Turner Street, E.16.

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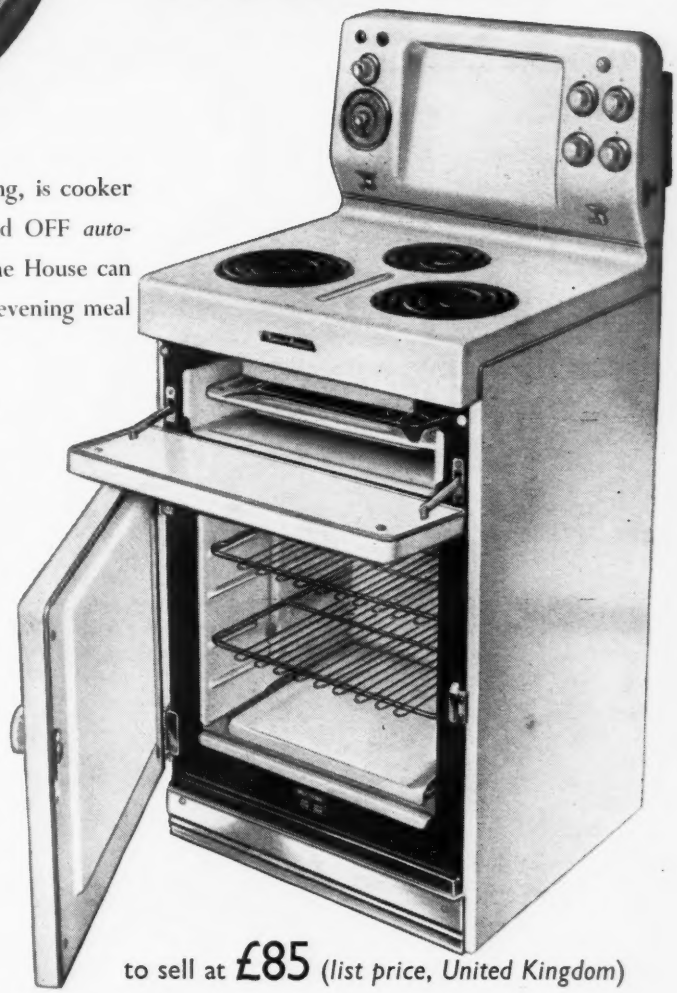
The FALCO ROYAL, with its Automatic Timing, is cooker and cook combined. It switches itself ON and OFF *automatically* at the times set for it. The Lady of the House can be out all day, and still come back to find the evening meal ready and piping hot!



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* Light in back-plate shines right into pans.
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* Removable oven linings, for easy cleaning.
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A product of FALCO ELECTRICAL APPLIANCES LIMITED
Corporation Road, Audenshaw, Manchester
PROPRIETORS: ALLIED IRONFOUNDERS LIMITED

REGD TRADE MARK

DRIVER-HARRIS INTERNATIONAL GATHERING

Great Expansion of Nickel-Alloy Applications

A continuing expansion of demand in every sphere of their activity was the keynote of the 5th International Gathering of the Driver-Harris Organisation. It was shown that the rising intensity of demand for the Driver-Harris alloys was due both to the great increase in the fields of application of nickel-containing alloys and to the fact that a growing number of the newer applications demanded characteristics and qualities which can be met only by precise conditions of manufacture and testing such as are provided by the Driver-Harris Organisation.

The four-day Conference, organised by British Driver-Harris Co., Ltd., Manchester, was held at Alderley Edge, Cheshire, at the middle of May, and attended by a large number of technical and sales representatives from home and many countries abroad.

Through intensive discussion, augmented by a comprehensive collection of examples of the newer end-uses of many of the alloys, those attending the Conference were given an unmistakable picture of the patterns and the volume of demand.

The chairman of the International Conference was Mr. R. M. Parry, Managing Director of British Driver-Harris Co., Ltd., supported by Mr. W. M. Kay, M.Sc., A.R.I.C., technical director, and Mr. W. F. Marsh, production director of the firm, together with Mr. F. L. Driver and Mr. S. M. Tracey of the American Company. In the photograph, Mr. Parry is seen addressing the gathering at the farewell dinner

ADVANCED USES

The continually increasing application of electronics, in so many scientific and industrial fields, is a main source of expanding demand for specialised alloys in the manufacture of which the British Driver-Harris Company is pre-eminent. Similarly, a tremendous surge of new and improved designs in instruments, resistors and other electrical components, is being met by the expanded production of "Nichrome V," "Nichrome," "Advance," and other Driver-Harris nickel-containing alloys.

AN UNUSUAL SITUATION

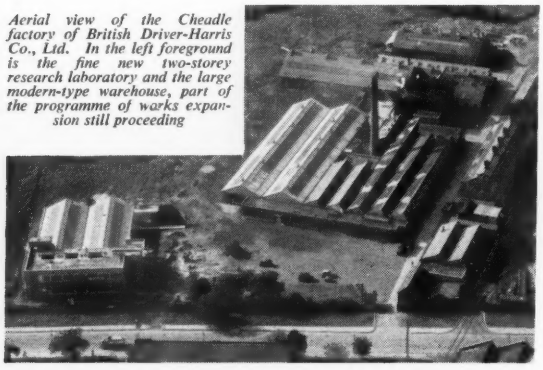
Moreover, there are the specialised and often critical requirements of jet propulsion, guided missiles, and radar, to name a few of the advanced uses of nickel and other alloys in projects of a vital scientific category.

A substantial expansion of demand in those specialised fields, is having the effect of contracting the possible sources of supply of alloys having the required qualities.

WHAT IS BEING DONE

By means of a carefully-phased programme of works and research extension, British Driver-Harris Co., Ltd., are abreast of the situation. It is thus that they are able to meet an expanding demand for alloys for well-established applications on electrical resistance as well as the additional production required by the newer and more specialised uses.

The latest additions at the Cheadle factory of British Driver-Harris Co., Ltd., include several new wire shops and new plant to expand the output of superfine wires in "Nichrome," "Nichrome V," "Advance" and "Karma" alloys. Another fine new building is a two-storey research laboratory (seen at the left in the aerial photograph). The laboratory, now almost ready for occupation will provide much-needed extra capacity for research and testing.



Aerial view of the Cheadle factory of British Driver-Harris Co., Ltd. In the left foreground is the fine new two-storey research laboratory and the large modern-type warehouse, part of the programme of works expansion still proceeding

BRITISH DRIVER-HARRIS CO. LTD.
MANCHESTER 15

"NICHROME"